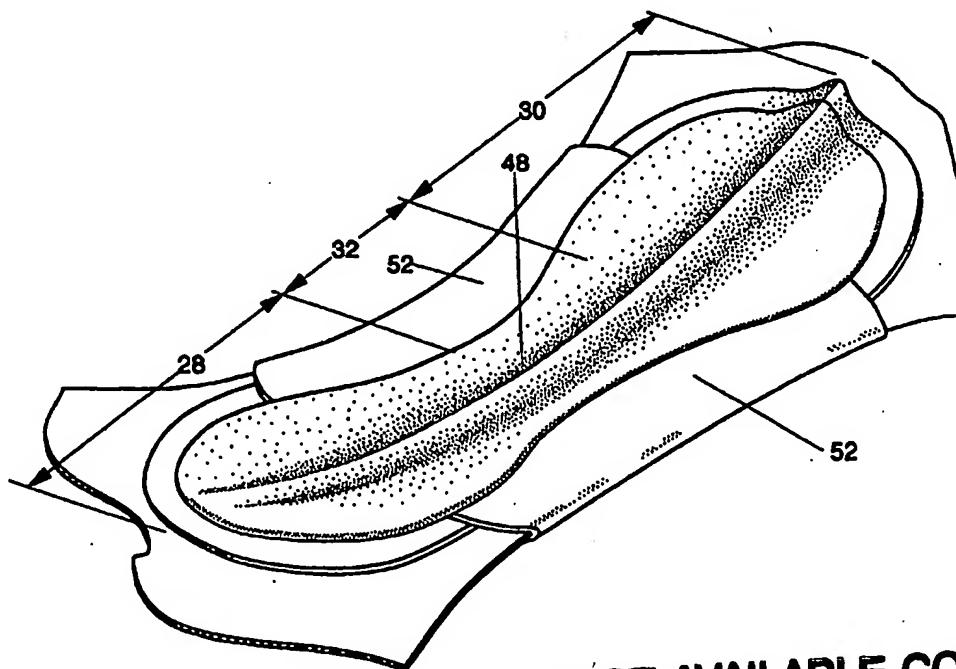




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(54) Title: SANITARY NAPKIN WITH EXPANDABLE FLAPS

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(57) Abstract

Absorbent articles, such as sanitary napkins, pantliners, or incontinence pads are described that comprise a pair of side extensions for folding around the side edges of a wearer's undergarment. The side extensions are joined to the main body portion and extend laterally outward beyond the longitudinal side edges of the main body portion. The side extensions can be provided on sanitary napkins that are either extensible or inextensible.

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Sanitary napkin with expandable flaps

FIELD OF THE INVENTION

The present invention relates to absorbent articles such as sanitary napkins, pantliners, and incontinence pads. More particularly, the present invention relates to sanitary napkins and the like which have improved side flap or side wrapping element configurations.

BACKGROUND OF THE INVENTION

Absorbent articles such as sanitary napkins, pantliners, and incontinence pads are devices that are typically worn in the crotch region of an undergarment. These devices are designed to absorb and retain liquid and other discharges from the human body and to prevent body and clothing soiling. Sanitary napkins are a type of absorbent article worn by women in a pair of panties that is normally positioned between the wearer's legs, adjacent to the perineal area of the body.

All manner and variety of absorbent articles configured for the absorption of body fluids such as menses, urine, and feces are, of course, well known. Absorbent articles, particularly sanitary napkins, having wings or flaps are disclosed in the literature and are available in the marketplace.

Generally, the flaps extend laterally from a central absorbent means and are intended to be folded around the edges of the wearer's panties in the crotch region. Thus, the flaps are disposed between the edges of the wearer's panties in the crotch region and the wearer's thighs. Commonly, the flaps are provided with an attachment means for affixing the flaps to the underside of the wearer's panties.

Typically, the currently marketed disposable absorbent articles of the types mentioned above also are made of materials that will not stretch. That is, the materials and the article itself will not stretch under the forces that the absorbent article is normally subjected to when worn. Recently, however, efforts have been directed toward providing extensible absorbent articles for improved comfort and

conformity with the wearer's body and undergarments. PCT Application Publication No. 93/01785 and its corresponding U.S. application Serial No. 07/915,133, filed July 23, 1992 (of which the present application is a continuation-in-part), discloses extensible absorbent articles.

It has been found, however, that unique problems arise when attempting to develop side flaps for such extensible absorbent articles, particularly when such absorbent articles and flaps are configured to cover large portions of the elasticized side edges of a wearer's undergarments. Some of these problems have also been found to be present in developing such flaps for use on generally inextensible absorbent articles. The search for improvements to the features of such absorbent articles has, therefore, continued.

Thus, a need exists for an absorbent article, such as a sanitary napkin, that is provided with improved side protecting elements, that are suitable for use with extensible or generally inextensible products, that fold better around the wearer's undergarments, are more convenient to use, manufacture, package, and carry.

It is, therefore, an object of the present invention to provide an absorbent article, such as a sanitary napkin, that is provided with improved side protecting elements, that are suitable for use with extensible or generally inextensible products, that fold better around the wearer's undergarments, are more convenient to use, manufacture, package, and carry.

These and other objects of the present invention will be more readily apparent when considered in reference to the following description and when taken in conjunction with the accompanying drawings.

SUMMARY OF THE INVENTION

The present invention provides an absorbent article, such as a sanitary napkin, pant liner, or incontinence pad. The sanitary napkin has a principal longitudinal centerline and a principal transverse centerline. The sanitary napkin comprises a main body portion comprising a topsheet, backsheet, and absorbent core. The main body portion comprises a first end region, a second end region (or "second region"), and a central region disposed between the end regions. The first end region and the central region can be considered to comprise a first region of the sanitary napkin. In a

preferred embodiment, the sanitary napkin is asymmetrically shaped so that the second end region is larger than the first end region. The sanitary napkin is preferably worn by the wearer so that the second end region is placed to the rear of the wearer's body.

The sanitary napkin also comprises a pair of side extensions for folding around the side edges of a wearer's undergarment. The side extensions can comprise side wrapping elements (or "panty covering components") that preferably automatically fold around the elasticized side edges of the wearer's panties when the sanitary napkin is placed in the wearer's panties and the panties are pulled up by the wearer, or side flaps that the wearer manually wraps around the panties. The side extensions are joined to the main body portion and extend laterally outward beyond the longitudinal side edges of the main body portion. The side extensions configurations can be provided on sanitary napkins that are either extensible or inextensible. The sanitary napkin is provided with various improved side extension configurations. In one preferred embodiment, the side extensions are joined to the garment-facing side of the main body portion, and comprise a first and a second region. The first region lies substantially laterally inboard of the longitudinal side edges of the main body portion, and is generally longitudinally extensible. The second region lies at least partially outboard of the longitudinal side edges when the flaps are extended, and is generally extensible in the transverse direction.

The side extensions can be provided with a second feature in the same embodiment, or in a separate embodiment. The side extensions are joined to the garment-facing side of the main body portion at a longitudinally-oriented juncture and extend from the juncture toward the principal longitudinal centerline of the sanitary napkin. The side extensions provided with this feature are folded back at a fold line to form a folded section. The side extensions are folded so that said distal edge of the side extensions extend laterally outward away from the principal longitudinal centerline. The side extension is unsecured to the garment-facing side of the main body portion to fold line so that the folded section of the side extensions can unfold and extend transversely when forces are applied to pull the side extension laterally outward.

In a third embodiment, the side extensions comprise at least two zones of extensibility, wherein at least one of the zones of extensibility is located on each side of the transverse centerline of the side extension and adjacent to the longitudinal side edges of the main body portion. The zones of extensibility are provided with

extensibility in different directions so that the extensibility of at least one of the zones of extensibility at least partially opposes the extensibility of at least one other zone of extensibility so that the side extension has an overall extensibility that is less than that of the sum of the extensibility of the different zones of extensibility.

The sanitary napkin can also be provided with numerous other features that improve the performance stability, ability to manufacture, or convenience to use the same. For example, the absorbent core may be slit in a central area, but not along the edges to reduce leakage of exudates and improve the stability of the sanitary napkin. In another example, features for the side extensions are described that allow side extensions with regions that are not extensible to be effectively joined to sanitary napkins having extensible main body portions.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as forming the present invention, it is believed that the invention will be better understood from the following description which is taken in conjunction with the accompanying drawings in which:

FIG. 1 is a top plan view of one example of a sanitary napkin having an extensible main body portion.

FIG. 2 is a side elevational view of the sanitary napkin shown in FIG. 1.

FIG. 3 is a schematic sectional view taken along line 3-3 of the sanitary napkin shown in FIG. 1.

FIG. 4 is a bottom plan view of the sanitary napkin shown in FIG. 1 shown with the release paper removed from the adhesive on the backsheet.

FIG. 5 is a perspective view of the sanitary napkin shown in FIGS. 1-4 in an in-use configuration.

FIG. 6 is a simplified plan view showing the extensibility of a sanitary napkin of a more conventional shape which has extensible components.

FIG. 7 is a table which shows preferred relationships between the magnitude of stretching forces applied to the sanitary napkin and the amount the sanitary napkin stretches in response to such forces.

FIG. 8 is a plan view of a preferred embodiment of a polymeric web material having a strainable network (shown with the deformations facing toward the viewer).

FIG. 9 is a segmented, perspective illustration of the polymeric web material of FIG. 8 in an untensioned condition.

FIG. 10 is a segmented, perspective illustration of a polymeric web material of FIG. 8 in a tensioned condition corresponding to stage I on the force-elongation curve depicted in FIG. 12.

FIG. 11 is a segmented perspective illustration of the polymeric web material of FIG. 8 in a tensioned condition corresponding to stage II on the force-elongation curve depicted in FIG. 12.

FIG. 12 is a graph of the resistive force versus percent elongation comparing the strainable web material shown in FIG. 8 with an otherwise identical, planar, base polymeric web material.

FIG. 13 is an enlarged plan view of the area where the topsheet and backsheet are mechanically bonded together in a manner which provides for extensibility.

FIG. 14 is a plan view of a modified crescent-shaped web that is attached to the sanitary napkin to form one of the pleated side wrapping elements.

FIG. 15 is a plan view of an alternative web of material having ring rolled sections that can be attached to the sanitary napkin to form one of the side wrapping elements.

FIG. 16 is a top plan view of one preferred embodiment of the sanitary napkin of the present invention having side extensions with a first region that is longitudinally extensible, and a second region that is generally extensible in the transverse direction (wherein only a portion of the pattern which is formed into the backsheet and side extensions is shown for clarity).

FIG. 17 is an end view of the sanitary napkin shown in FIG. 16.

FIG. 18 is a bottom plan view of the sanitary napkin shown in FIG. 16.

FIG. 19 is a schematic bottom plan view showing some optional features that could be provided on the sanitary napkin of the present invention.

FIG. 19A is a bottom plan view of an alternative sanitary napkin in which only the longitudinal central region of the backsheet has a strainable network formed therein.

FIG. 20 is a bottom plan view of a portion of a sanitary napkin having a side extension that is provided with a tab-shaped distal edge.

FIG. 21 is a top plan view of a sanitary napkin having a side extension arranged in an alternative folded configuration (with only one side extension shown).

FIG. 22 is an end view of the sanitary napkin shown in FIG. 21 shown with two side extensions.

FIG. 23 is a bottom plan view showing a portion of a sanitary napkin having a side extension that is provided with an alternative tab arrangement.

FIG. 23A is an end view of the portion of the sanitary napkin shown in FIG. 23 with the side extension and tab folded prior to use.

FIG. 23B is an end view of the portion of the sanitary napkin shown in FIG. 23 with the side extension in one possible in-use configuration.

FIG. 24 is a bottom plan view showing a portion of a sanitary napkin having a side extension that is provided with spaced apart zones having components of extensibility that are oriented in opposing directions so that the side extension has an overall extensibility that is less than that of the sum of the extensibility of said zones of extensibility.

FIG. 24A is a bottom plan view showing a portion of a sanitary napkin having a side extension that is provided with a plurality of slits in a diamond-shaped pattern.

FIG. 25 is a bottom plan view showing a portion of an alternative sanitary napkin having a side extension that is provided with flaccid or excess material along its distal edge.

FIG. 26 is a side view showing the distal edge of the sanitary napkin shown in FIG. 25 when the sanitary napkin is laid flat on a surface such as a table.

FIG. 27 is a perspective view of the Cantilever Drape Tester.

DETAILED DESCRIPTION OF THE INVENTION

1. General Characteristics of the Absorbent Article

FIGS. 1-5 show a preferred embodiment of a disposable absorbent article of the present invention 20. The term "absorbent article," as used herein, refers to articles which absorb and contain body exudates. More specifically, the term refers to articles which are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. The term "absorbent article" is intended to include sanitary napkins, pantliners, and incontinence pads (and other articles worn in the crotch region of a garment). The term "disposable" refers to articles which are intended to be discarded after a single use and preferably recycled, composted, or otherwise disposed of in an environmentally compatible manner. (That is, they are not intended to be laundered or otherwise restored or reused as an absorbent article.) In the preferred embodiment illustrated, the absorbent article is a sanitary napkin designated 20.

The term "sanitary napkin", as used herein, refers to an article which is worn by females adjacent to the pudendal region that is intended to absorb and contain the various exudates which are discharged from the body (e.g., blood, menses, and urine). It should be understood, however, that the present invention is also applicable to other feminine hygiene or catamenial pads such as panty liners, or other absorbent articles such as incontinence pads, and the like.

The sanitary napkin 20 has two surfaces, a liquid pervious body-contacting surface or "body surface" 20A and a liquid impervious garment surface 20B. The sanitary napkin 20 is shown in FIG. 1 as viewed from its body surface 20A. The body surface 20A is intended to be worn adjacent to the body of the wearer. The garment surface 20B of the sanitary napkin 20 (shown in FIG. 2) is on the opposite side and is intended to be placed adjacent to the wearer's undergarments when the sanitary napkin 20 is worn.

The sanitary napkin 20 has two centerlines, a principal longitudinal centerline L and a principal transverse centerline T. The term "longitudinal", as used herein, refers to a line, axis or direction in the plane of the sanitary napkin 20 that is generally aligned with (e.g., approximately parallel to) a vertical plane which bisects a standing wearer into left and right body halves when the sanitary napkin 20 is worn. The terms "transverse" or "lateral" used herein, are interchangeable, and refer to a line, axis or direction which lies within the plane of the sanitary napkin 20 that is generally perpendicular to the longitudinal direction. The sanitary napkin 20 has a longitudinal dimension that runs in the general direction of the principal longitudinal centerline L, and a (typically shorter) transverse dimension that runs in the general direction of the principal transverse centerline T.

FIG. 1 shows that the sanitary napkin 20 has a main body portion 21 with two spaced apart longitudinal edges 22, two spaced apart transverse or end edges (or "ends") 24, and four corners 27, which together form the periphery 26 of the main body portion 21 of the sanitary napkin 20. The main body portion 21 also has two end regions, which are designated first end region 28 and second end region 30. A central region 32 is disposed between the end regions 28 and 30. The end regions 28 and 30 extend outwardly from the edges of the central region 32 about 1/8 to about 1/3 of the length of the main body portion. A detailed description of the central region 32 and the two end regions 28 and 30 is contained in U.S. Patent 4,690,680 issued to Higgins on September 1, 1987. The sanitary napkin 20 has a longitudinal central region 23 disposed along the length of at least a portion of the principal longitudinal centerline L (and preferably centered about the same).

The sanitary napkin 20 (or main body portion thereof) can be of any thickness, including relatively thick, relatively thin, or even very thin. The embodiment of the sanitary napkin 20 shown in Figures 1-3 of the drawings is intended to be an example of a relatively thin sanitary napkin (having a caliper of less than or equal to about 5 mm, more preferably less than or equal to about 4 mm), and preferably is an "ultra-thin" sanitary napkin. It should be understood, however, when viewing these figures the number of layers of material shown cause the sanitary napkin 20 to appear much thicker than it actually is. An "ultra-thin" sanitary napkin 20 as described in U.S. Patents 4,950,264 and 5,009,653 issued to Osborn preferably has a caliper of less than about 3 millimeters. The thin sanitary napkin 20 shown should also be preferably relatively flexible, so that it is comfortable for the wearer.

In other embodiments, the longitudinal central region 23 of the sanitary napkin 20 may be provided with an absorbent hump or some other type of raised region or structure so that a portion of the sanitary napkin has a relatively high caliper, and the surrounding regions 25 have a lesser caliper. Preferably, the surrounding regions, and in particular the end regions, have a caliper of less than or equal to that of the thin sanitary napkins described above. While the longitudinal central region 23 is shown in Fig. 1 as a rectangular strip that extends the length of the sanitary napkin, it should be understood that the raised region, and, thus, the longitudinal central region 23 may be of many other shapes.

The surrounding regions 25 are the significant absorbent portions of the sanitary napkin that lie outboard of the longitudinal central region 23. The term "outboard" means positioned away from the intersection of the principal longitudinal and transverse centerlines, L and T. The surrounding regions 25 may be referred to as "longitudinal side regions" (or "side regions") 25 because they will typically lie at least transversely outboard of the raised region so that they are on both longitudinal sides of the raised region and the sanitary napkin (hence the name "longitudinal side regions"). The surrounding regions 25 can, however, lie outboard of the longitudinal central region 23 in either a longitudinal direction (i.e., outside the ends of the raised region in the end regions 28 and 30), a transverse direction, or both.

FIG. 3 shows the individual components of the sanitary napkin 20 of the present invention. The sanitary napkin shown in FIG. 3 generally comprises at least three primary components. These include a liquid pervious topsheet 38, a liquid impervious backsheet 40, and an absorbent core 42 positioned between the topsheet 38 and the backsheet 40. The preferred embodiment shown in FIGS. 1-3 also comprises a less extensible element 44 at least partially located in the central region 32 that deflects in response to stretching (and preferably lifts to provide improved body contact).

The sanitary napkin may be comprised of several of the basic components described in PCT Publication Nos. WO 93/01785 and 93/01786, and is preferably comprised of one or more extensible components, and more preferably, is comprised of all extensible components (with the exception of the less extensible element), and, thus, has an overall extensibility. The extensibility of the sanitary napkin 20 is shown in a simplified fashion in FIG. 6. The term "extensible", as used herein refers to articles that can increase in at least one of their dimensions in the x-y plane. The x-y plane is a plane generally parallel to the faces of the sanitary napkin 20. The term

extensible includes articles that are stretchable and elastically stretchable (defined below). The sanitary napkin 20 shown in Figures 1-5 is preferably extensible both in length and width. In its most preferred embodiments, the sanitary napkin is extensible in all directions in the x-y plane. The sanitary napkin 20, in other embodiments however, may be generally inextensible, only extensible in one of these directions, or extensible in the same direction between the longitudinal and transverse directions. Preferably, the sanitary napkin 20 is extensible at least in the longitudinal direction.

The sanitary napkin 20 may in some preferred embodiments, in addition to being extensible, also be stretchable. The term "stretchable", as used herein, refers to articles that are extensible when stretching forces are applied to the article and offer some resistance to stretching. More preferably still, the sanitary napkin 20 may be elastically stretchable. The terms "elastically stretchable" or "elastically extensible" are intended to be synonymous. These terms, as used herein, mean that when the stretching forces are removed, the sanitary napkin will tend to return toward its unextended or unstretched (or "original" dimensions). The sanitary napkin 20 need not return all the way to its unstretched dimensions, however. It may, as shown in Figure 6, return to relaxed dimensions (such as L_R and W_R) between its unstretched dimensions and extended (or stretched dimensions) L_S and W_S . Making the sanitary napkin elastically stretchable will reduce the undesirable tendency of the sanitary napkin to gather longitudinally inward (i.e., bunch longitudinally and become sloppy) when forces which tend to stretch the sanitary napkin are removed such as when the wearer's panties contract.

The sanitary napkin 20 embodiment shown in Figs. 1-5 is preferably extensible in the amounts described in PCT Publication Nos. WO 93/01785 and WO 93/01786. To summarize the same, the sanitary napkin is preferably capable of extending about 5% to less than about 50%, more preferably between about 10% and about 40%, and most preferably between about 25% and about 40% under the forces associated with wearing the sanitary napkin in a pair of panties. Preferably, the sanitary napkin is capable of such extension under forces of between about 50 - 100 grams to about 1,000 - 1,500 grams, more preferably under forces of between about 250 grams and about 800 grams. Other preferred amounts of extensibility are set forth in Table 1 (FIG. 7). The sanitary napkin of the present invention can also be provided with any of the other features of the sanitary napkins described in the above publications including, a structure that provides a "force wall" to prevent elongation

past a certain amount without substantial increases in the amount of force applied to the sanitary napkin.

In addition, in some especially preferred embodiments described in greater detail herein, various embodiments of the sanitary napkin 20 are capable of smaller amounts extension under forces at the low end of the broadest range set forth above (e.g., forces in the range of about 100 - 200 grams). For instance, in such embodiments, the sanitary napkin is preferably capable of extending about 2.5%, more preferably about 3% at 100 grams force, and about 5%, more preferably about 7.5% at 200 grams force. In absorbent articles with such small amounts of extensibility under low forces, the force wall may also occur at low elongations, such as about 5% elongation, but may occur at elongations up to about 50% elongation.

Further, in embodiments of the sanitary napkin (or other absorbent article) of the present invention which are extensible, the sanitary napkin is preferably extensible in at least the same amounts and under the same forces as the wearer's panties (or other undergarments) so that the panties control the extensibility of the sanitary napkin during wear. In other words, the sanitary napkin preferably has a modulus of elasticity that is close to, and preferably less than or equal to that of the undergarment in which it is placed. For example, if the undergarment requires a force to extend about 5% (or about 10%), the sanitary napkin (that is, the main body portion thereof) may require a force to extend the same amount that is less than or equal to about 1.2 times, preferably less than or equal to about 1 times the force required to extend the undergarment. The force required to extend the crotch region of a typical North American-type woman's panty in the transverse direction (at the narrowest point of the same) is about 135 g/cm. The force required to extend the portions of the back panel of such a panty where the second end region of the sanitary napkin might lie in the longitudinal direction is about 165 g/cm. A typical force to elongate the panty elastics of a North American cotton panty is about 135 g/in. Elastic forces for other types of panties or undergarments may be somewhat higher. The main body portion of the sanitary napkin of the present invention is preferably also extensible at such forces that it can be extended by hand by a consumer in order to increase the absorbent surface area of the napkin at least about 5% without destruction of the main body portion.

Several additional matters should be noted regarding extensibility of the sanitary napkin. The extensibility referred to herein is distinct from mere wrinkling or unfolding of an absorbent article, as well as the straightening of a product curved by

elasticity (or by other means), and that any lengthening resulting from such actions is not considered to involve extension of an absorbent article in the x-y plane. In addition, it is within the scope of the present invention for an absorbent article to have portions or regions that are extensible and portions or regions which are relatively inextensible. If desired, if the properties of such portions of an absorbent article fall within any of the ranges and limits specified herein, the aforementioned ranges and limits can be equally applicable to only portions of an absorbent article, and may be described as such in the appended Claims.

The sanitary napkin (or other type of absorbent article) of the present invention preferably also has the other properties described in U.S. Patent Application Serial No. 08/192,240 entitled "Absorbent Articles" filed in the name of Osborn, et al. on February 4, 1994, and its continuation-in-part filed February 2, 1995 (Serial No. not yet assigned), both of which are incorporated by reference herein. These other properties include, but are not limited to: the size and shape of the absorbent article, body contact (e.g., lift), area coverage, drapability and flexibility, responsiveness to compressive force and resiliency, wet bunch recoverability, and test capacity and total capacity. The sanitary napkin may, however, may have various properties described for the absorbent articles in the patents incorporated by reference herein.

2. The Individual Components of the Sanitary Napkin and the Assembly of the Same.

The individual components which may be suitable for the various embodiments of the sanitary napkin 20 of the present invention will now be looked at in greater detail with reference to one preferred embodiment shown in FIGS. 1-3.

A. The Topsheet

The topsheet 38 comprises a first liquid pervious component. When the sanitary napkin 20 is in use, the topsheet 38 is in close proximity to the skin of the user. The topsheet 38 may be extensible or inextensible depending on the type of absorbent article it is used with. The topsheet 38 used in the embodiment shown in FIGS. 1-5 is preferably extensible, more preferably elastically extensible, and as compliant, soft feeling, and non-irritating to the user's skin as possible. The topsheet 38 should further exhibit good strikethrough and a reduced tendency to rewet, permitting bodily discharges to rapidly penetrate it and flow toward the core 42, but

not allowing such discharges to flow back through the topsheet 38 to the skin of the wearer.

The topsheet 38 has two sides (or faces or surfaces), including a body-facing side 38A and a garment-facing side (or core-facing side) 38B. The body-facing side 38A of the topsheet 38 generally forms at least a portion of the body-contacting surface ("body surface") 20A of the sanitary napkin 20. The topsheet 38 has two longitudinal edges 38C and two end edges 38D. (A similar numbering system applies to the other components of the sanitary napkin. That is, the side of the component facing the wearer's body can be designated by the number of the component and a reference letter "A". The side facing the wearer's undergarments can be designated by the number of the component and the letter "B". The side and end edges can be designated by the number of the component and the reference letters "C" and "D", respectively.)

A suitable topsheet 38 may be manufactured from a wide range of materials including, but not limited to woven and nonwoven materials, apertured formed thermoplastic films, apertured plastic films, hydro-formed films, porous foams, reticulated foams, reticulated thermoplastic films, and thermoplastic scrims. Suitable woven and nonwoven materials can be comprised of natural fibers (e.g., wood or cotton fibers), synthetic or modified natural fibers (e.g., polymeric fibers, such as polyester, polypropylene fibers, and polyethylene, or polyvinylalcohol, starch base resins, polyurethanes, cellulose esters, nylon, and rayon fibers) or from a combination of natural and synthetic fibers. When the topsheet 38 comprises a nonwoven web, the web may be spunbonded, carded, wet-laid, meltblown, hydroentangled, combinations of the above, or the like.

Apertured films are generally preferred for the topsheet 38 because they are pervious to liquids and, if properly apertured, have a reduced tendency to allow liquids to pass back through and rewet the wearer's skin. Suitable apertured films are described in U.S. Patent 3,929,135 issued to Thompson on December 30, 1975, U.S. Patent 4,324,426 issued to Mullane et al. on April 13, 1982, U.S. Patent 4,342,314 issued to Radel et al. on August 3, 1982, U.S. Patent 4,463,045 issued to Ahr, et al. on July 31, 1984, and U.S. Patent 5,006,394 issued to Baird on April 9, 1991. A particularly suitable topsheet 38 is made in accordance with U.S. Patent 4,342,314 issued to Radel, et al. and U.S. Patent 4,463,045 issued to Ahr, et al. A topsheet 38 made of model X-3265 or model P1552 apertured formed film sold by Tredegar Corporation of Terre Haute, Indiana has been found to work well.

The topsheet 38 can be made extensible by performing a mechanical operation, such as pleating, corrugating, or ring rolling on the topsheet material to provide folds in the topsheet that are able to open when the topsheet is stretched. Such a process can be performed on many of the topsheet materials described above. In one preferred embodiment of the present invention, the topsheet 38 is made in accordance with U.S. Patent 4,463,045 and ring rolled to provide it with a degree of longitudinal extensibility. Such a topsheet is described in U.S. Patent Application Serial No. 07/936,195 entitled "Polymeric Web Having Deformed Sections Which Provide a Substantially Increased Elasticity To The Web", filed in the name of John J. Curro, et al. on August 25, 1992.

Suitable processes for ring rolling or "pre-corrugating" are described in U.S. Patent 4,107,364 issued to Sisson on August 15, 1978, U.S. Patent 4,834,741 issued to Sabee on May 30, 1989, U.S. Patent 5,143,679 issued to Gerald M. Weber, et al. on September 1, 1992, U.S. Patent 5,156,793 issued to Kenneth B. Buell, et al. on October 20, 1992, and U.S. Patent 5,167,897 issued to Gerald M. Weber, et al. on December 1, 1992.

The fold lines in the corrugations of a ring rolled topsheet preferably run at least in the transverse direction so the topsheet is longitudinally extensible. In other embodiments, the fold lines could run in the longitudinal direction, both directions, and/or other directions. The topsheet 38 will be extensible in directions perpendicular to the fold lines.

In the particularly preferred embodiment shown in Figs. 1-5, the topsheet 38 comprises an apertured web material with a strainable network which exhibits elastic-like behavior without added elastic materials. A web material with such a strainable network may be referred to herein as a "strainable apertured web material" or, for brevity, as a "strainable web material" or simply as the "web material". (It is noted that these latter two terms may include web materials that are apertured or nonapertured.) This type of material is also referred to herein as a structural elastic-like film or "SELF" material.

The strainable apertured web material can, in a preferred embodiment, comprise an apertured formed polymeric film such as a film which is made in accordance with the aforementioned patents issued to Radel, et al. and Ahr, et al. In one highly preferred embodiment, the starting material for the topsheet comprises an apertured film has an absorbent component integrally formed with it which defines its

garment-facing side and that it could be any of the types of materials described in Section 2E below. The following description of the material with the strainable network, will be applicable to both apertured materials and non-apertured materials since the SELF technology is also useful in forming preferred components for the backsheet. For clarity in seeing the other components of the sanitary napkin, only a portion of the topsheet 38 is shown in Fig. 1 as being SELFed.

The strainable web material can be made of a base material that has a relatively low extensibility under the forces the sanitary napkin is normally subjected to when worn. When formed into the strainable web material as described herein, however, the base material, thus formed, will be extensible under these forces. The strainable web material can also be formed into a structure that provides a "force wall" to be created at specific, pre-selected elongations and forces. The strainable web material is preferably comprised substantially of linear low density polyethylene (LLDPE). The strainable web material may also be comprised of other polyolefins such as polyethylenes, including low density polyethylene (LDPE), ultra low density polyethylene (ULDPE), high density polyethylene (HDPE), or polypropylene and blends thereof with the above and other materials. Examples of other suitable polymeric materials which may also be used include, but are not limited to polyester, polyurethanes, compostable or biodegradable polymers, heat shrink polymers, thermoplastic elastomers, and breathable polymeric structures.

The strainable web material 60 is shown in Figs. 8 and 9 without apertures for simplicity. Figs. 8 and 9 show the strainable web material 60 in its substantially untensioned condition. The strainable web material has two centerlines, a longitudinal centerline, which is also referred to hereinafter as an axis or direction "l" and a transverse or lateral centerline, which is also referred to hereinafter as an axis or direction "t". The lateral centerline "t" is generally perpendicular to the longitudinal centerline "l". In a preferred embodiment, the longitudinal centerline l of the strainable web material is aligned with the principal longitudinal centerline L of the sanitary napkin. In other embodiments, however, the longitudinal centerline l of the web material can be oriented in other directions, depending on the direction of extensibility desired.

As shown in Figs. 8 and 9, strainable web material 60 includes a "strainable network" of distinct and dissimilar regions. As used herein, the term "strainable network" refers to an interconnected and interrelated group of regions which are able to be extended to some useful degree in a predetermined direction providing the

strainable web material with an elastic-like, relatively low resistive force stage and a relatively high resistive force stage. The strainable network includes at least a first region 64 and a second region 66. The first and second regions each have a first surface and an opposing second surface. In the preferred embodiment shown in Figs. 8 and 9, the strainable network includes a plurality of first regions 64 and a plurality of second regions 66. The first regions 64 have a first axis 68 and a second axis 69, wherein the first axis 68 is preferably longer than the second axis 69. The first axis 68 of the first region 64 is substantially parallel to the longitudinal axis, *l*, of the strainable web material 60 while the second axis 69 is substantially parallel to the transverse axis, *t*, of the strainable web material 60. The second regions 66 have a first axis 70 and a second axis 71. The first axis 70 is substantially parallel to the longitudinal axis of the strainable web material, while the second axis 71 is substantially parallel to the transverse axis of the strainable web material. In the preferred embodiment of Fig. 8, the first regions 64 and the second regions 66 are substantially linear, extending continuously in a direction substantially parallel to the longitudinal axis of the strainable web material.

The first region 64 of the strainable network has an elastic modulus $E1$ and a cross-sectional area $A1$. The second region 66 of the strainable network has a modulus $E2$ and a cross-sectional area $A2$.

In the embodiment illustrated, a portion of the strainable web material 60 has been "formed" such that the entire strainable web material exhibits a controlled resistive force along a predetermined axis when subjected to an applied axial elongation in a direction substantially parallel to such an axis. In the case of the embodiment illustrated, the predetermined axis is substantially parallel to the longitudinal axis of the web material. As used herein, the term "formed" refers to the creation of a desired structure or geometry upon the web material that will substantially retain the desired structure or geometry when it is not subjected to any externally applied elongations or forces. As used herein, the term "formed portion" refers to the portion of the material which is comprised of the desired structure or geometry of the strainable network. Suitable methods for forming a material such as the strainable web material described herein include, but are not limited to embossing by mating plates or rolls, thermoforming, high pressure hydraulic forming, or casting.

The web material used in the present invention is comprised of a strainable network of contiguous, "distinct", and "dissimilar" regions, wherein the strainable network includes at least a first region and a second region, where the first region has

a "surface-pathlength" less than that of the second region. The surface pathlength is measured parallel to a predetermined axis when the material is in an untensioned state. As used herein, the term "surface-pathlength" refers to a measurement along the topographic surface of the region in question in a direction parallel to the predetermined axis. As used herein, the term "distinct" or "dissimilar" when referring to regions, refers to regions within the strainable network having measurably different surface-pathlengths as measured parallel to a predetermined axis while the web material is in an untensioned condition.

In the preferred embodiment shown in Figs. 8 and 9, the first regions 64 comprise a substantially planar region. That is, the material within the first region 64 is in substantially the same condition before and after the formation step undergone by strainable web material. The second regions 66 include a plurality of continuous, interconnected, deformations 74 which extend alternately beyond the plane of both the first and second surfaces (64A and 64B, respectively) of first region 64. In other embodiments, the deformations 74 may extend beyond the plane of only one of either the first or the second surfaces of the first region.

The deformations 74 have a first axis 76 which is substantially parallel to the transverse axis of the web material and a second axis 77 which is substantially parallel to the longitudinal axis of the strainable web material. The first axis 76 of the deformations 74 is at least equal to, and preferably longer than the second axis 77. To enhance the two-stage resistive force versus elongation behavior characteristics of the strainable web material 60 used in the sanitary napkin 20 of the present invention, the ratio of the first axis 76 to the second axis 77 is at least 1:1, and preferably at least 2:1 or greater. In general, the greater this ratio, the more pronounced will be the two-stage resistive force versus elongation characteristic of the web material.

The first region 64 and the second region 66 each have a "projected pathlength". As used herein the term "projected pathlength" refers to length of a region as viewed perpendicularly to the surface of the web material measured parallel to the pre-determined axis (i.e., parallel to the longitudinal axis) of the strainable web material 60. The projected pathlength of the first region 64 and the projected pathlength of the second region 66 are equal to one another.

However, the first region 64 has a surface-pathlength, L1, less than the surface-pathlength, L2, of the second region 66 as measured topographically parallel to the longitudinal axis of the web material while the web material is in an

untensioned condition. To enhance the two-stage resistive force versus elongation behavior characteristic of the strainable web material 60, the surface-pathlength of the second region 66 is at least about 15 percent greater than that of the first region, more preferably about 30 percent greater than that of the first region, and most preferably at least about 70 percent greater than that of the first region.

The web material 60 exhibits a modified "Poisson lateral contraction effect" substantially less than that of an otherwise identical unformed web material of the prior art. As used herein, the term "Poisson lateral contraction effect" describes the lateral contraction behavior of a material which is being subjected to an applied elongation. Preferably the Poisson lateral contraction effect of the web material of the present invention is less than about 0.4 when the web is subjected to about 20 percent elongation. Preferably, the web material exhibits a Poisson lateral contraction effect less than about 0.4 when the web material is subjected to about 40, 50, or even 60 percent elongation. More preferably, the Poisson lateral contraction effect is less than about 0.3 when the web material is subjected to 20, 40, 50, or 60 percent elongation.

For the strainable web material, the direction of applied axial elongation, indicated by arrows 80, is substantially perpendicular to the first axis 76 of the deformations 74. (The amount of axial elongation is distance, D.) As the deformations 74 are able to extend in a direction substantially perpendicular to their first axis 76, the direction of applied axial elongation to cause extension in strainable web material is also substantially perpendicular to the first axis 76 of the deformations 74.

While the direction of applied axial elongation, indicated by arrows 80, is substantially perpendicular to the first axis 76 of the deformations 74, an applied axial elongation having a longitudinal component will cause the strainable web material to extend in the direction of applied axial elongation.

Fig. 12 is an exemplary graph of a resistive force-elongation curve 720 of a formed polymeric web material of the present invention along with a similar curve 710 for a planar, base polymeric film from which the web material is formed. Referring now to the force-elongation curve 720, there is an initial substantially linear, lower force versus elongation stage I designated 720a, a transition zone designated 720b, and a substantially linear stage II designated 720c which displays substantially higher force versus elongation behavior, corresponding to a resistive

force wall beyond which the web material may undergo additional permanent deformation.

As seen in Fig. 12 a formed web material having a strainable network exhibits a controlled multi-stage behavior when subjected to an applied elongation in a direction parallel to the longitudinal axis of the web material. The resistive force to the applied elongation is significantly different between stage I (720a) and stage II (720c) of curve 720 as compared to curve 710 which does not exhibit this behavior. Referring now to Fig. 10, as the web material is subjected to an applied axial elongation indicated by arrows 80 in Fig. 8, the first region 64 having the shorter surface-pathlength, L1, provides most of the initial resistive force, P1, to the applied elongation which corresponds to stage I. While in stage I, the deformations 74 in the second region 66 are mostly out of the plane of applied elongation and offer minimal resistance to the applied elongation. In the transition zone between stages I and II, the deformations 74 are becoming aligned with the applied elongation. In stage II, as seen in Fig. 11, the deformations 74 in the second region 66 have become substantially aligned with the plane of applied elongation and begin to resist further elongation. The second region 66 now contributes a second resistive force, P2, to further elongation. The first and second resistive forces to elongation provide a total resistive force, PT, which is greater than the resistive force provided by the first region 64. Accordingly, the general slope of the force-elongation curve in stage II displays the characteristics of a force wall that is significantly greater than the general slope of the force-elongation curve in stage I.

The resistive force P1 is substantially greater than the resistive force P2 when (L1+D) is less than L2. While (L1+D) is less than L2 the first region 64 provides an initial resistive force, P1, generally satisfying the equation:

$$P1 = \frac{(A1 * E1 * D)}{L1}$$

When (L1+D) is greater than L2 the first and second regions provide a combined total resistive force, PT, to the applied elongation D, generally satisfying the equation:

$$PT = \frac{(A1 * E1 * D)}{L1} + \frac{(A2 * E2 * |L1 + D - L2|)}{L2}$$

(Where "*" represents a multiplication sign.)

The maximum elongation occurring while in stage I is considered to be the "available stretch" of the web material. The available stretch can be effectively determined by inspection of the force-elongation curve 720, the approximate point at which there is an inflection in the transition zone between stage I and stage II is the percent elongation point of "available stretch". The range of available stretch can be varied from about 10% to 100% or more; this range of elastic-like response is often found to be of interest in disposable absorbent articles, and can be largely controlled by the extent to which surface-pathlength L2 in the second region 66 exceeds surface-pathlength L1 in the first region 64 and the properties of the base film. Significantly higher forces are required to achieve percent elongations in the base film equivalent to those percent elongations in the web 60. The approximate extent of stage I can be controlled as desired by adjusting the pathlengths, L1 and L2 in an untensioned condition. The force-elongation behavior of stage I can be controlled by adjusting the width, thickness, and spacing of first region 64 and the properties of the base film.

When the web material of Fig. 8 is subjected to an applied elongation, the web material exhibits an elastic-like behavior as it extends in the direction of applied elongation and retracts to its substantially untensioned condition once the applied force is removed, unless extended to the point of yielding. The web material is able to undergo multiple applications of applied elongation without losing its ability to substantially recover. Accordingly, the web material is able to retract to its substantially untensioned condition once the applied elongation or force is removed.

While the web material may be easily and reversibly extended in the direction of applied axial elongation, in a direction substantially perpendicular to the first axis 76 of the deformations 74, web material is relatively non-extensible in a direction substantially parallel to the first axis 76 of the deformations 74. The plastic deformation imparted upon the deformations 74 allows the deformations to be extended in one direction, in a direction substantially perpendicular to the first axis of the deformations, while being relatively non-extensible in a direction substantially perpendicular to the direction of extension, in a direction substantially parallel to the first axis of the deformations. In other embodiments, however, the strainable web material 60 can be provided with first regions 64 that extend in different directions to make the strainable web material 60 extensible in more than one direction. For example, the strainable web material 60 can be provided with first regions 64 that

extend outward from a center and second regions 66 that are disposed in concentric circles around the center to make the strainable web material 60 extensible in all directions in the x-y plane.

The amount of applied force required to extend the web material is dependent upon the inherent properties of the base material forming the web material and the width and spacing of the undeformed regions 64, with narrower and more widely spaced undeformed regions 64 requiring lower extensional forces to achieve the desired elongation. The first axis 68, (i.e., the length) of the undeformed regions 64 is preferably greater than the second axis 69, (i.e., the width) with a preferred length to width ratio of between 5:1 and 300:1.

The depth and number of deformations 74 can also be varied to control the applied force or elongation required to extend the web material of the present invention. In one preferred embodiment, the deformations are formed by two rigid plates having outer dimensions of 5.0" by 12" by 0.75". On one surface of each plate are a series of meshing teeth which are substantially triangular in cross section and measure 0.030" at their bases and taper to a vertex with a radius of 0.008" at the top. The centerlines of the teeth are spaced evenly and at 0.030" increments. On the "toothed" side of one plate, a series of grooves are cut which are parallel to each other and perpendicular to the evenly spaced teeth. These grooves measure 0.031" wide and are continuous over the entire length of the plate, and are spaced at a distance of 0.25" on center. These grooves correspond to the undeformed regions of the deformed web of material.

The preferred LLDPE base material is placed between the plates in a hydraulic press having platens larger than the plates to evenly distribute pressure. The plates are compressed under a load of at least 4,000 pounds. The formed web material is then removed from between the plates. The available stretch or elongation is increased if for a given number of deformations, the height or degree of deformation imparted on the deformations is increased. Similarly, the available stretch or elongation is increased if for a given height or degree of deformation, the number or frequency of deformations is increased.

In preferred embodiments, the topsheet 38 is rendered hydrophilic so that liquids will transfer through the topsheet 38 faster. This will diminish the likelihood that body exudates will flow off the topsheet rather than being drawn through the topsheet and being absorbed by the absorbent core. The topsheet can be rendered

hydrophilic by treating it with surfactants. Suitable methods of applying surfactants are described in U.S. Patents 4,950,254 and 5,009,653 issued to Osborn (which include incorporating the surfactant into the polymeric material of a formed film topsheet) as well as treating the surface of the component underlying the topsheet with a surfactant.

In addition, in preferred embodiments, the inner surface 38B of topsheet 38 is secured in contacting relation with an underlying absorbent layer. This contacting relationship results in liquid penetrating topsheet 38 faster. The topsheet 38 may be kept in a contacting relationship with an underlying layer by bonding the topsheet to the underlying layer. However, it is not absolutely necessary to bond the face of the topsheet 38 to the face of the underlying layer. The topsheet 38 can be maintained in contact with an underlying absorbent component by applying adhesives between the topsheet and the underlying component, by entangling the fibers of the underlying layer with the topsheet, by fusing the topsheet 38 to an underlying absorbent layer by a plurality of discrete individual fusion bonds, or by any means known in the art.

B. The Absorbent Core

The absorbent core 42 is positioned between the topsheet 38 and the backsheet 40. The absorbent core 42 provides the means for absorbing exudates such as menses and other body fluids. The absorbent core 42 need not have an absorbent capacity much greater than the total amount of body fluids anticipated to be absorbed. In fact, the absorbent core 42 may have a capacity that is substantially less than the amount of bodily exudates required to be absorbed if the less extensible element 44 has a capacity sufficient to absorb most or all of such bodily exudates. The absorbent core 42 is generally compressible, conformable, and non-irritating to the user's skin.

In the embodiment shown in Figs. 1-5, the absorbent core 42 is preferably extensible. The absorbent core 42, however, need not be extensible in all embodiments to provide a benefit. For example, a relatively inextensible core can be used in an embodiment in which the topsheet together with an underlying absorbent component (or integral absorbent component) is extensible and the topsheet and such absorbent component are not attached to the face of the core so that they are able to separate from (or "decouple" from) the core. The concept of decoupling (in general) is described in U.S. Patent 5,007,906 issued to Osborn on April 16, 1991. Such an embodiment is useful if the topsheet 38 is capable of extending independently of the

absorbent core and any other underlying components which are relatively inextensible. In such an embodiment, the topsheet can play a large part in providing the desired body conformity and comfort for the wearer notwithstanding the inextensibility of the underlying components.

The absorbent core 42 can comprise any material used in the art for such purpose including natural materials and synthetic materials. Non-limiting examples of such materials include natural materials such as comminuted wood pulp (which is generally referred to as airfelt), creped cellulose wadding, hydrogel-forming polymer gelling agents, creped tissues or creped nonwovens containing fibers comprised of absorbent or superabsorbent polymers, modified cross-linked cellulose fibers (such as those described in U.S. Patent 5,217,445 issued to Young, et al. on June 8, 1993), capillary channel fibers (that is, fibers having intra-fiber capillary channels such as those described in U.S. Patent 5,200,248 issued to Thompson, et al. on April 6, 1993), absorbent foams (such as those described in U.S. Patent 5,260,345, issued to DesMarais, et al. on November 9, 1993, and U.S. Patent 5,268,224 issued to DesMarais, et al. on December 7, 1993), thermally bonded airlaid materials (such as those materials described in U.S. Patent Application Serial No. 08/141,156, entitled "Catamenial Absorbent Structures Having Thermally Bonded Layers for Improved Handling of Menstrual Fluids, and Their Use in Catamenial Pads Having Improved Fit and Comfort" filed in the name of Richards, et al. on October 21, 1993 (P&G Case 5051), absorbent sponges, synthetic staple fibers, polymeric fibers, peat moss, or any equivalent material or combinations of materials.

The polymeric gelling agents listed above may also be referred to as "absorbent gelling materials" ("AGM"), or "superabsorbent materials". Polymeric gelling agents are those materials which, upon contact with liquids such as water or other body liquids, imbibe such liquids and thereby form hydrogels. In this manner, liquids discharged into the absorbent core 42 can be acquired and held by the polymeric gelling agent, thereby providing the articles herein with enhanced absorbent capacity and/or improved liquid retention performance. The polymeric gelling agent which is employed in the absorbent core 42 will generally comprise particles of a substantially water-insoluble, slightly cross-linked, partially neutralized, hydrogel-forming polymer material. The polymeric gelling agent can be in many forms, including in the form of particles, flakes, or fibers.

In one preferred embodiment, the absorbent core 42 is a laminate. The laminate is comprised of a layer of superabsorbent polymer material, such as in the

form of particles 41, disposed between two air-laid tissues, first and second tissue layers. The first and second tissue layers provide containment of the superabsorbent polymer material, improve lateral wicking of the absorbed exudates throughout the absorbent core 42 and provide a degree of absorbency. The tissue layers can be comprised of a single tissue web which is folded with the superabsorbent material particles between, or two separate sheets of the same (or different) tissue. A suitable laminate is a superabsorbent laminate known as WATER-LOCK L-535 available from the Grain Processing Corporation of Muscatine, Iowa (WATER-LOCK registered TM by Grain Processing Corporation). Such superabsorbent laminates are disclosed in U.S. Patent 4,467,012, issued to Pedersen et al. on August 21, 1984, U.S. Patent 4,260,443, issued to Lindsay et al. on April 7, 1981, and U.S. Patent 4,578,068 issued to Kramer, et al. on March 25, 1986.

The absorbent core materials described above can be made extensible in many different ways, including by cutting or slitting the same. Figure 1 shows an embodiment in which the topsheet 38 is partially cut away and the absorbent core 42 is a laminate as described above which is slitted or partially slitted with transverse slits for longitudinal extensibility. The entire plan view area of the absorbent core 42 can be provided with slits of the type shown in Fig. 1, or only a portion of the core can be provided with slits. Preferably, in the embodiment shown in Fig. 1, the entire core is slit. In alternative embodiments, the portions of the absorbent core 42 that lie beyond the less extensible element 44 can be slit and the portion of the core that lie below the less extensible element 44 can be unslit, or vice versa. In other embodiments, the majority of the absorbent core 42 can be slit (or otherwise provided with extensibility) and regions or bands around the periphery of the core can be unslit to provide the edges of the core with stability and to reduce wicking of exudates from the sides of the core 42.

The longitudinal and end edges 22 and 24 of the main body portion 21 are preferably sealed to prevent the wicking and expulsion of liquid or any liquid-containing superabsorbent material from the napkin when it is extended. Alternatively, the longitudinal edges 42C and edges 42D of the absorbent core 42 may be sealed rather than sealing the edges of the entire main body portion. The edges of the core 42 may, for example, be wrapped or covered by a tissue layer. In other alternative embodiments, the edges of the tissue may be folded, or otherwise manipulated to prevent the wicking and expulsion of liquid or liquid-containing superabsorbent material particles 41 from the core 42. All permanent seals around

the perimeter of the main body portion should not break upon lengthening (i.e., any seal is intended to remain for the duration of the use of the sanitary napkin).

C. The Backsheet

The backsheet 40 prevents the exudates absorbed and contained in the absorbent core 42 from wetting articles which contact the sanitary napkin 20 such as pants, pajamas and undergarments. The backsheet 40 should be flexible and impervious to liquids (e.g., menses and/or urine).

The backsheet 40 may comprise a woven or nonwoven material, polymeric films such as thermoplastic films of polyethylene or polypropylene, or composite materials such as a film-coated nonwoven material. Preferably, the backsheet 40 is a thin plastic film, such as a polyethylene film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils). Exemplary polyethylene films are manufactured by Clopay Corporation of Cincinnati, Ohio, under the designation P18-1401 and by Tredegar Film Products of Terre Haute, Indiana, under the designation XP-39385. In the preferred embodiment shown in Figs. 1-5, the backsheet 40 is formed by SELFing one of these exemplary polymeric films.

D. The Less Extensible Element

The sanitary napkin 20 shown in Figs. 1-5 is also preferably provided with an optional less extensible or non-extensible region or less extensible element (or "insert") 44 that is positioned between the topsheet 38 and the absorbent core 42. The insert 44 is preferably located approximately in the central region 32 of the sanitary napkin 20, but as shown in Fig. 1, the insert 44 may also lie at least partially in the first end region 28 of the sanitary napkin (or, even in the second end region 30 of the sanitary napkin). In the particularly preferred embodiment shown, the insert 44 is activated in response to forces from at least two different sources. The insert 44 preferably both deflects in response to stretching of the rest of the sanitary napkin (and preferably deflects upward in the center or lifts to provide improved body contact) and also preferably deflects upward in response to inward compressive forces exerted by the wearer's thighs during use.

The insert 44 has a body-facing side 44A, a garment-facing side 44B, a pair of longitudinal edges 44C, and a pair of end edges 44D. The insert 44 can generally be any type of component that is less extensible than at least some of the other parts of the main body portion 21 of the sanitary napkin 20. The insert 44 may be relatively

inextensible. In other embodiments, the less extensible element may have a degree of extensibility, albeit a lesser degree of extensibility than the other parts of the main body portion 21.

The insert 44 should preferably be flexible. The flexibility of the insert 44 should be enough that the sanitary napkin is comfortable to wear. The flexibility of the insert 44 is not unlimited, however, since the less extensible element 44 must resist flexibility enough to maintain the sanitary napkin in the desired in use configurations without collapsing under the forces associated with wearing the napkin. The structure of the insert 44 is preferably rigid enough, however, to allow bowing or buckling to occur when inwardly-oriented lateral compressive forces are applied to the longitudinal edges 44C of the less extensible element. The insert 44 should preferably not collapse inward (i.e., "squash" like a sponge) without providing any z-direction lift in response to the lateral compressive forces exerted on the sanitary napkin 20 during use. The insert 44 can be in the form of a layer of material, or in some other suitable form. The insert 44 will preferably maintain sufficient rigidity when it is both dry and after it has become wet (such as by body exudates). The insert 44 is preferably also flexure-resistant, reformable, and moisture stable as these terms are defined in the U.S. Patent 5,171,302 issued to Buell. The insert 44 and the sanitary napkin may also be made to assume many of the cross-sectional configurations described in the aforementioned patent. More particularly, the insert described herein has an improved structure which is designed to achieve the desired in-use configurations even more efficiently in thinner, more consumer-friendly executions.

The insert 44 should be laterally compressible under relatively low forces so that the sanitary napkin is comfortable to wear. When worn, sanitary napkin and other related catamenial products are subjected to lateral compression forces. When these compressive forces are released, the sanitary napkin may rebound from its compressed state. The insert 44 may be resilient enough that it moves back to its uncompressed configuration in use after the laterally inward compressive forces exerted by the wearer's thighs are removed. Alternatively, if the insert is joined to the longitudinal side edges of the absorbent core, the insert may passively expand with the panty crotch when the compressive forces exerted by the wearer's legs are removed. This ensures that the insert 44 will enable the sanitary napkin 20 to cover a large portion of the wearer's panties during use and to minimize lateral leakage of exudates around the sides of the sanitary napkin which leads to staining of the wearer's panties (which may be referred to as "side soiling").

The insert 44 may be made from many of the basic types of materials specified herein. These materials, however, preferably should not be subjected to any process (such as SELFing, ring rolling, pleating, corrugating, or slitting) to provide the material with extensibility. FIGS. 1-5 show an embodiment in which the insert 44 comprises an unslit absorbent laminate. The insert 44 is preferably also designed to provide for controlled buckling such as by folding it to create a medial longitudinally-oriented fold line in the same.

In a particularly preferred embodiment, the insert 44 is a laminate comprising a thermally bonded absorbent material fabricated from a blend of cellulose and synthetic fibers. Such a preferred material for the insert 44 is described in the aforementioned U.S. Patent Application Serial No. 08/141,156, entitled, "Catamenial Absorbent Structures Having Thermally Bonded Layers for Improved Handling of Menstrual Fluids, and Their Use in Sanitary napkins Having Improved Fit and Comfort" filed in the name of Richards, et al. on October 21, 1993. Particularly preferred thermally bonded absorbent material is obtained as DANWEB material #1079-2338 and 2339 from Dan Web of Aarhus, Denmark. DANWEB material #1079-2338 comprises a homogeneous blend of about 70% Flint River fluff (cellulose), 15% DANAKLON ES-C 1.7 dtex x 6 mm bicomponent fibers, and about 15% Nalco 1180 absorbent gelling material particles. DANWEB material #1079-2338 is formed into a web having a basis weight of about 152 grams/m², a caliper of about 1.2 mm measured under a load of 0.2 psi, and a density of about 0.13 g/cc. The insert 44 preferably comprises a laminate of DANWEB #1079-2338 material and at least one layer of an 18 g/yd² (21.5 g/m²) spunbonded polypropylene nonwoven material known as CELESTRA available from Fiberweb, North America of Simpsonville, SC, which is then embossed with the pattern described in U.S. Patent 4,781,710 issued to Megison, et al. on November 1, 1988. The nonwoven material is preferably melted onto the back of the DANWEB material using a hot iron at 300°F taking care to ensure that the laminate retains a degree of perviousness.

The insert 44 may be simply placed on top of the core 42 and held in place by fitting snugly against the surrounding components of the sanitary napkin 20. In the embodiment shown in FIGS. 1-5, the insert 44 is affixed at a single point 46 on each of its longitudinal side edges. When the sanitary napkin 20 is elongated, the central region 32 of the napkin narrows. This causes the insert 44 to bow or buckle and form a ridge 48 (shown in FIG. 5) along the principal longitudinal centerline L of the sanitary napkin 20.

In the preferred embodiment shown, the topsheet 38, backsheet 40, and absorbent core 42 are extensible, and the insert 44 is positioned on top of the absorbent core and is less extensible than these other components. The melting of the nonwoven material on the bottom of the insert 44 provides the insert 44 with a smoother bottom surface (that is, one that has a lower coefficient of friction) so that when the underlying absorbent core 42 is stretched, the insert 44 will be able to more easily slide relative to the core 42. This is believed to improve the ability of the core 42 to stretch and cause this less extensible insert 44 to pop up.

E. Other Optional Components

The sanitary napkin 20 of the present invention may be provided with optional additional components. The sanitary napkin 20 of the present invention can, for instance, be provided with one or more additional pervious or absorbent portions or layers. The additional pervious or absorbent portions or layers may be an integral part of one of the components of the sanitary napkin, such as the topsheet or absorbent core, or they may be a separate layer positioned between the absorbent core 42 and either the topsheet 38, the backsheet 40, or both. FIG. 3 shows that in the preferred sanitary napkin embodiment shown in Figs. 1-5, an underlying absorbent portion, such as wicking material (or acquisition material) 50 forms the garment-facing side of the topsheet 38. In the embodiment shown in Figure 3, the acquisition component 50 is a nonwoven material having the same configuration as the absorbent core 42 that is attached by adhesives and integrated with the formed film portion of the topsheet and is SELFed along with the formed film prior to the assembly of the sanitary napkin. One material suitable for use as the acquisition component 50 of the topsheet is an air-through bonded nonwoven material comprised of bi-component fibers which is manufactured under the tradename HAVIX S2146 by the Havix Corporation, Gifu-City, Japan (formerly known as Fukumura). This material is oriented so that its extensibility is lengthwise and its "fuzzy" side is placed adjacent to the film.

F. Combinations of Topsheet, Backsheet, and Core Materials and Assembly of the Same Into the Main Body Portion of the Sanitary Napkin.

The main body portion 21 of the sanitary napkin 20 of the present invention can be comprised of any combinations of the different topsheet, backsheet, and core materials described herein. The main body portion 21 may, as noted above, be

comprised of all extensible components. The main body portion may also be comprised of any of the other types or combinations of extensible or inextensible topsheets, backsheets and absorbent cores that are described in PCT Publication Nos. WO 93/01785 and 93/01786.

The components of the main body portion described above (the topsheet, backsheet, and absorbent core) can be assembled in any suitable manner. In the preferred embodiment shown in Figures 1-3, the components of the main body portion are assembled in a "sandwich" configuration with the components sized so that the edges of the topsheet 38 and backsheet 40 extend outward beyond the edges of the absorbent core 42. The topsheet 38 and backsheet 40 are preferably at least partially peripherally joined using known techniques. As shown in Figure 1, the topsheet 38 is preferably secured to backsheet 40 along a seam, such as seam 90. Seam 90 is preferably liquid impervious. The seam 90 can be formed by any means commonly used in the art for this purpose such as by gluing, crimping, or heat-sealing.

The term "joined", as used herein, encompasses configurations in which an element is directly secured to another element by affixing the element directly to the other element; configurations in which the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element; and configurations in which one element is integral with another element, i.e., one element is essentially part of the other element.

The components of the sanitary napkin 20 can be joined together by adhesives, stitching, heat and/or pressure bonds, dynamic mechanical bonds, ultrasonic bonds, intermingling or entanglement of the fibers or other structural elements comprising the components of the sanitary napkin, such as by meltblowing the fibers comprising one component onto another component, extruding one component onto another, or by any other means known in the art. Suitable means for attaching the components of the sanitary napkin are described in U.S. Patent Application Serial No. 07/810,744 filed in the name of Cree, et al. on December 17, 1991 (PCT Patent Publication No. WO 93/11725 published on June 24, 1993).

When the main body portion 21 is comprised of extensible components, the components can be joined together in any suitable manner that allows at least portions of the main body portion 21 to extend. It is possible that a relatively inextensible liquid impervious crimp seal of the type currently used on known

sanitary napkins can be used for this purpose, and the main body portion 21 will still achieve acceptable amounts of extensibility.

In the extensible sanitary napkin embodiment shown in FIGS. 1-5, the portions of the topsheet and backsheet at the edges of the topsheet and backsheet, however, are secured together using an extensible adhesive 92 around the perimeter of the sanitary napkin and in addition, a plurality of mechanical bonds 94 in the perimeter area. The extensible adhesive 92 provides an impervious extensible seal around the perimeter of the sanitary napkin. The mechanical bonds 94 (only a portion of which are shown in Fig. 1) provide added strength. The mechanical bonds 94 are arranged in intermittent zones (or regions) of bonded and nonbonded areas.

FIG. 13 shows the details of one pattern of bonded and unbonded areas 96 and 98 that can be used for this purpose. In the embodiment shown in FIG. 13, the bonded areas comprise a plurality of spaced apart line segments that are approximately perpendicular to the longitudinal edges 42C of the absorbent core 42 at each bond. The bonded areas 96, thus, typically have at least a component that is oriented in the transverse direction. The bonded areas 96 can, in other embodiments, be in many suitable patterns, including but not limited to geometric shapes, such as circles or squares or other suitable configurations or in continuous or intermittent lines. Regardless of the exact pattern which is used, the bonded areas should be spaced apart in the desired direction of extensibility for the completely assembled absorbent article so they are separated by unbonded areas. The bonded areas 96 are not extensible and the unbonded areas 98 are extensible.

The bonded areas 96 are preferably formed by a heat and pressure process in which the application of temperature and pressure are carefully controlled so that neither the material comprising the topsheet nor the material comprising the backsheet are melted in the process. If either the temperature or the pressure is too high, and the topsheet, the backsheet, or both are melted, the bond formed will become brittle which may result in the topsheet and/or backsheet material tearing at the bond site. A suitable seal of a SELFed polyethylene formed film topsheet and a SELFed polyethylene film backsheet can be formed by a heated plate having bonded areas as shown in Fig. 1 which are approximately 6 mm x 2 mm which are spaced 5 mm apart. The plate is heated to 170°F for 5 seconds and the seal is formed using hand pressure.

The above manners of joining the components are preferred for ease of construction. (Other means of uniting the various components can be used.) For instance, the present invention also includes so-called "tube" products. In these products, a liquid pervious cover material (such as topsheet material) can be wrapped completely around the absorbent core and the backsheet, and then the components can be secured together. In alternative arrangements, the topsheet could be wrapped around the core, and the wrapped core could be placed on and secured to the backsheet.

G. Side Extensions

The sanitary napkin 20 preferably also comprises a pair of side extensions 52, one of which is located along each longitudinal side edge 22 of the main body portion 21. The side extensions 52 can comprise side wrapping elements (or "panty covering components") that preferably automatically fold around the elasticized side edges of the wearer's panties when the sanitary napkin is placed in the wearer's panties and the panties are pulled up by the wearer, or side flaps that the wearer manually wraps around the panties.

The description herein of the side extensions 52 being "joined to", "located along" (or "associated with") the longitudinal side edges 22 of the main body portion 21 is intended to include embodiments in which the side extensions 52 are integral with the main body portion 21 (and comprise extensions of the components thereof, such as the topsheet and the backsheet) as well as embodiments in which the side extensions 52 comprise separate elements that are attached to the main body portion 21 either at or inboard of the longitudinal side edges 22 of the main body portion 21. If the side extensions 52 comprise separate elements, they may be attached to any portion of the main body portion 21, such as the body-facing side, the garment-facing side, or some point in between these two sides.

The side extensions 52 may be extensible, inextensible, or partially extensible and partially inextensible (that is, they may have some regions which are extensible, and some regions that are less extensible). If the side extensions are extensible, they may be extensible generally in the longitudinal direction, generally in the transverse direction, or in any direction between the longitudinal and transverse directions.

The embodiment shown in FIGS. 1-5 provides an example of side extensions that may be in the nature of side wrapping elements for purposes of discussion. The side wrapping elements 52 comprise a pair of separate elements, one of which is

attached to the garment-facing side 20B of the napkin along each longitudinal side edge 22 of the main body portion 21. Each side wrapping element 52 preferably comprises a modified crescent-shaped piece or web of extensible material as shown in Fig. 14. The inside edge of the web of material is concave prior to attachment along the longitudinal side edge 22 of the main body portion 21. The crescent-shaped webs each have a proximal edge 54 adjacent to the place where the side wrapping elements 52 are attached to (or extend from) the main body portion 21, and each side wrapping element extends outward to a distal edge 56. The distal edge 56, as shown in Fig. 4, has a shape that defines two rounded portions (or lobes) 58A and 58B in plan view. These rounded portions (referred to together by reference number 58) are located near the ends of the web of material. Fig. 4 shows that the rounded portions 58A and 58B on the distal edges of the side wrapping elements 52 are separated by an intermediate section 58C of the distal edge. The intermediate section 58C of the distal edge 56 is disposed closer to the longitudinal centerline of the sanitary napkin than the outermost points of the rounded portions. In the embodiment shown in FIGS. 1-5, the intermediate section 58C is given this configuration by spreading open the inside edge of the crescent-shaped pieces and attaching them so that they follow the curvature of the longitudinal side edges 22 of the main body portion 21. In the process of attaching the side wrapping elements 52, in this embodiment at least one, and preferably two, pleats 59 are formed in the side wrapping element 52 where a first portion of the side wrapping element overlaps a second portion of the side wrapping element.

FIG. 4 shows that the end edges 57 of the side wrapping elements 52 preferably form an angle α of less than or equal to about 90° with the longitudinal centerline. The angle α becomes more important as the length of the side wrapping elements 52 increases, particularly when the side wrapping elements are greater than or equal to about 170 mm long (as measured parallel to the longitudinal centerline along the proximal edge of the side wrapping elements). Keeping the angle α under the angles specified above assists the side wrapping elements in folding under the wearer's panties. In particular, the proper angle α prevents the undesirable tendency for the side wrapping elements 52 to flip the ends of the main body portion back on themselves when the sanitary napkin is placed in the wearer's panties. This is particularly important in the areas where the side wrapping elements align with the regions of the panty leg openings that have the greatest curvature (i.e., the smallest radii of curvature). The regions of the panty leg openings that have the greatest

curvature are typically found furthest longitudinally outward from the narrowest portion of the panty crotch.

The side wrapping elements 52 may be provided with any of the properties described in the disclosures of U.S. Patent Application Serial No. 08/096,121 entitled "Absorbent Articles Having Panty Covering Components That Naturally Wrap the Sides of Panties" filed in the name of Lavash, et al. on July 22, 1993 (PCT Publication No. WO 94/02096 published February 3, 1994), and U.S. Patent Application Serial No. 08/124,180 entitled "Absorbent Articles Having Panty Covering Components Comprising Extensible Web Materials Which Exhibit Elastic-Like Behavior" filed in the name of Mansfield, et al. on September 20, 1993.

Various alternative embodiments of the side wrapping elements 52 are also possible. For instance, as shown in FIG. 15, in another embodiment, instead of providing the side wrapping elements 52 with pleats to allow the side wrapping elements to expand when they are folded around the sides of the wearer's panties, the side wrapping elements 52 can be provided with ring rolled sections, SELFed sections, or corrugations at various portions of the side wrapping elements 52.

In still other alternative embodiments of the present invention, the sanitary napkin 20 may be provided with flaps that extend outwardly from each longitudinal edge 22 of the sanitary napkin 20. The flaps may be in any suitable configuration. Suitable flaps may, for example, be made in accordance with the teachings of U.S. Patents 4,589,876, issued May 20, 1986 to Van Tilburg, U.S. Patent 4,687,478, issued August 18, 1987 to Van Tilburg, U.S. Patent 5,267,992 issued to Van Tilburg on December 7, 1993, U.S. Patent 5,330,461 issued to Leeker on July 19, 1994, U.S. Patent 5,344,416 entitled "Absorbent Article Having Inwardly-Folded Pleated Flaps" issued to Niihara, et al., on September 6, 1994, U.S. Patent 5,346,486 entitled "Sanitary Napkin Having Laterally Extensible Means for Attachment to the Undergarment of the Wearer", issued to Osborn, et al. on September 13, 1994, and U.S. Patent 5,389,094 entitled "Absorbent Article Having Flaps and Zones of Differential Extensibility" to be issued to Lavash, et al. on February 14, 1995. In other alternative embodiments, the sanitary napkin can be provided with side wrapping elements that have one or more features of the flaps described in the aforementioned patents and patent applications.

Figs. 16-18 show one preferred embodiment of the sanitary napkin of the present invention. The embodiment shown in Figs. 16-18 has side extensions 52

which preferably have at least two regions with different directions or primary components of extensibility. The term "primary component of extensibility", as used herein, refers to a vector component that is oriented in the direction of the predominant extensibility of the region.

The side extensions 52 preferably each comprise at least a first region 52A that has a primary component of extensibility in a first direction D_1 , and a second region 52B that has a primary component of extensibility in a second direction D_2 . However, other variations are also possible. The first region 52A underlies the main body portion 21, and in the embodiment shown in Figs. 16-18 is extensible generally in the longitudinal direction. The second region 52B comprises at least some portions that lie laterally outboard of the longitudinal side edges 22 of the main body portion 21 when the side extensions are extended which are extensible primarily in the transverse direction. The longitudinal extensibility of the first region 52A of the side extensions 52 allows the main body portion 21 of the sanitary napkin, which is joined thereto, to freely extend in the longitudinal direction. It should also be understood, however, that the side extension design shown in Figs. 16-18 may also be useful on sanitary napkins having generally inextensible main body portions. The transverse extensibility of the second region 52B allows the side extensions to expand laterally when they are wrapped around the curved side edges of the wearer's panties. This allows the side extensions to better fit around the panties without wrinkling and without stresses being exerted on the side extensions. To further reduce stresses on the side extensions when they are folded around the side of the wearer's panties, the side extensions may be provided with a slit, or a notch at their distal edge 56 as described in U.S. Patent 4,589,876, issued to Van Tilburg.

Figures 16-18 show a preferred version of this alternative embodiment in which the side extensions 52 are not only joined to the main body portion, but are also doubled-back and folded to form pockets, and then tucked into the pockets when not deployed. The side extensions 52 are preferably joined to the main body portion 21 at a flange 55 that is formed where the side extensions 52 are folded back, and also at the ends 57 of the side extensions 52. The portions at the ends 57 of the side extensions 52 which are joined to the main body portion 21 are also preferably tapered or cut at a slant as shown in Fig. 18. The longer end edge of the side extensions 52 is preferably disposed further from the principal longitudinal centerline so that the pocket formed by folding the side extensions is provided with a wider mouth for ease in tucking the side extensions 52 within the pockets. The side extensions can be joined to the main body portion by any suitable means known in

the art for joining components of an absorbent article. In the preferred embodiment shown, an extensible adhesive is used to join the side extensions 52 to the main body portion 21.

The proximal edges 54 of the side extensions 52 are preferably joined to the main body portion 21 along a longitudinally oriented line bond 100. The end regions 57 of the flaps (and preferably only a portion thereof as shown in Fig. 18) are joined to the main body portion 21 along diagonal end bonds 102.

The folding or doubling back of the side extensions 52 at the proximal edges provides unsecured portions 53 that can be extended when the sanitary napkin is worn to provide the side extensions with additional transverse extensibility. It should be understood that this is a particularly preferred embodiment, and in other embodiments, the side extensions 52 can merely be attached to the backsheet in a simple fashion. Suitable arrangements for folding and tucking the flaps of a sanitary napkin are further described in U.S. Patent 5,281,209 issued to Osborn, et al. on January 25, 1994.

In the preferred embodiment illustrated in Figs. 16-18, the side extensions 52 comprise a laminate of polypropylene air-through bonded nonwoven on top of a LLDPE film which is then SELFed. The laminate is "formed" by the SELFing process so that the first and second regions 52A and 52B each comprise a strainable network 60 similar to that shown in Fig. 8. However, in the first region 52A of the side extensions 52, the longitudinal direction, *l*, of the strainable network (and, thus, the first regions 54 of the same) is generally oriented in the longitudinal direction, and in the second region 52B of the side extensions 52, the longitudinal direction, *l*, of the strainable network (and, thus, the first regions 64 of the same) are generally oriented in the transverse direction.

In addition, since the SELFing process produces a highly flexible and drapable material, it is preferable that the side extensions 52 be reinforced or otherwise provided with at least some areas that are stiffer than the SELFed laminate. Otherwise, the side extensions 52 may be too floppy and difficult to handle. Preferably, as shown in Fig. 18, the side extensions 52 are provided with a stiffer region 52C near their distal edges 56. In the embodiment shown, the stiffer region 52C is provided by providing the side extensions with a release surface or strip 89 that covers the side extension adhesive 88 when the side extensions 52 are folded and tucked into the pockets. (Fig. 18 shows that instead of the usual single patch of

adhesive, there are preferably multiple zones of side extension fasteners 88 on the side extensions. These multiple zones are needed due to the length of the side extensions and the need to secure the entire side extension 52 in place underneath the wearer's panties.)

The stiffer region 52C preferably also aids in the wrapping of the side extensions 52 around the edge of the wearer's panties by ensuring that the remaining less stiff portions of the side extensions "follow" the stiffer region 52C (or, in other words, that the entire side extension moves as an integral unit with the stiffer region 52C). This can be contrasted with situations in which a side extension 52 is provided with extensible regions without any stiffened regions. In this case, when the distal edge 56 of the side extensions 52 is grasped to fold the side extensions around a wearer's panties, some portions of the side extensions 52 may stretch, but if there are any portions on the opposite side of the stretchable portions, (i.e., remote portions) such portions will not move as well as the rest of the side extension when the distal edge is moved. This is due to the fact that the majority of the movement takes place in the stretchable portions. There is a reduced tendency for this to occur when the side extensions 52 are provided with stiffened regions 52C, particularly along the entire distal edge 56 of the same.

Fig. 19 shows that in various embodiments of the present invention, it may also be desirable for the side extensions 52 and/or the main body portion 21 to comprise portions or regions that are less extensible than the remainder of the side extensions 52 or the main body portion 21. These less extensible portions or regions 51 can be slightly less extensible than the other regions, or sufficiently less extensible that they have very little extensibility under the forces normally encountered when the sanitary napkin 20 is worn, or even generally inextensible. One reason it is desirable to provide the sanitary napkin 20 with such less extensible regions is that it is frequently difficult to attach one highly textured material such as a SELFed material to another due to the surface texture of the SELF material. This is especially true when adhesives are used for this purpose since there is generally a need to have close surface contact between the surfaces to be bonded when adhesives are employed. For the same reason, it may be desirable to have less extensible regions when applying adhesive fasteners on the garment side of the SELF material.

It has been found that the less extensible portions or regions 51 can be located at a number of places on the sanitary napkin 20 without unduly interfering with the extensibility characteristics of the sanitary napkin. As a general matter, the

less extensible regions 51 should be relatively small in size and located close to the edges of the main body portion 21. These locations, as shown in Fig. 19, include, but are not limited to along or around the longitudinal edges of the main body portion, the end edges of the main body portion, or around the entire perimeter of the main body portion. The less extensible regions 51 could, for example, include less extensible portions 51A of the main body portion 21 or the absorbent core 42 along the longitudinal side edges 22 (or 42C) of the same. These less extensible regions 51 could also include less extensible portions 51B at the ends of the main body portion 21 or at the ends of the absorbent core 42. It has also been found, unexpectedly, that acceptable performance can even be achieved with less extensible regions 52 around the entire periphery 26 of the sanitary napkin. This is believed to be possible because of the portions of the sanitary napkin located inboard of the periphery 26 will be able to extend and more in the Z-direction (perpendicular to the x-y plane) to conform to the wearer's body and/or the panties. The less extensible portions 51C can also be present in selected areas where the adhesive fasteners 82 are applied to the sanitary napkin. In addition, the portions of the side extensions 51D that form retaining members or pockets for the side extensions could also be less inextensible if they are secured close to the longitudinal side edges 22 of the main body portion 21.

Preferably, if less extensible elements, such as the side extensions are attached to the main body portion 21, they are located sufficiently close to the longitudinal side edges 22 of the main body portion 21 that there is a gap between the attachment points for the opposing side extensions 52 that is greater than or equal to about 40 mm (measured in the transverse direction).

Fig. 19A shows another embodiment of the sanitary napkin of the present invention. In the embodiment shown in Fig. 19A, a strainable network 60 is only formed in a portion of the backsheet 40 along the longitudinal central region 23 of the sanitary napkin 20. The strainable network 60 can extend the entire length of the sanitary napkin 20 as shown in Fig. 19A, or only a portion of the length of the sanitary napkin 20. A similar pattern could also be present on the topsheet 38.

The limitation of the formed region 60 to the longitudinal central region 23 of the sanitary napkin provides a number of advantages. It has been found that providing the backsheet 40 in such a configuration assists the sanitary napkin in achieving the in-use configuration shown in Fig. 5. This is especially beneficial for the second end region 30 of the sanitary napkin. The backsheet 40 shown in Fig. 19A is believed to improve body contact by enabling the ridge 48 formed on top of

the sanitary napkin to fit closely in the crevice between the wearer's buttocks. In a preferred version of this embodiment, regions of the absorbent core 42 along the longitudinal side edges of the same may be unslit to further assist the sanitary napkin 20 in assuming the in-use configuration shown in Fig. 5. The improved body contact in this region is believed to be due to the difference in extensibility and stiffness provided by the backsheet in the longitudinal central region 23 versus the corresponding properties of the longitudinal side regions 25. The fact that the backsheet 40 is firmly anchored to the wearer's panties at its ends by fasteners 84 also assists the sanitary napkin in assuming such in-use configuration.

The embodiment shown in Fig. 19A may also be preferred for ease of manufacture since the side extensions 52 can be secured more easily to the unformed portions of the backsheet 40 in the longitudinal side regions 25 of the sanitary napkin. In addition, regions near the end edges 40D of the backsheet 40 can be left unformed for ease in attaching the fasteners 84 to the backsheet 40.

Fig. 20 shows an alternative side extension 52 configuration for use on the sanitary napkin of the present invention. The alternative side extension 52 configuration shown in Fig. 20 is provided with a tab portion on its distal edge 56. The distal edge 56 of the side extension, due to the presence of the tab 108, is substantially less wide in the longitudinal direction than the distal edge 56 of the side extensions of the sanitary napkin shown in the preceding figures (such as Fig. 18). The shape of the side extension 52 shown in Fig. 20 provides several advantages. First, the material in the side extensions 52 which is laterally outboard of the side extension fasteners 88 in the prior figures does not adhere to the underside of the wearer's panties. This excess material 110 tends to wrinkle and exert stresses on the remaining portions of the side extensions 56 when it is folded around the curved side edge of the wearer's panty crotch. The tab portion 108 provides the distal edge 56 of the side extensions 52 with a shape which has a reduced tendency to wrinkle and exert such stresses due to the elimination of such excess material 110 that are aligned with those portions of the wearer's panty crotch which are provided with the greatest curvature during use. The tab portion 108 also provides the side extensions 52 with a convenient graspable tab that the user can pull on to extend the side extensions for use.

Figs. 21 and 22 show an alternative way of folding the side extensions 52 prior to use. In Figs. 21 and 22, the side extensions 52 are folded over the body-facing side 20A of the main body portion 21. The portions of the side extensions

comprising the distal edges 56 of the same are folded or doubled back so that the distal edges 56 extend laterally outward away from the principal longitudinal centerline L. The side extensions 52 can be retained in this configuration in any suitable manner, such as by placing a temporary fastener such as a spot of paraffin 112 between the side extensions 52 and the body-facing side 20A of the main body portion 21. The side extensions 52 each comprise a distal portion 56E that is located between the fold line and the distal edge 56 of the side extensions. These distal edge portions 56E are preferably retained in place by adhering the side extension fastening adhesive 88 located on the distal portion of the side extensions to a complementary release surface 89 located on the proximal portion 54E of the side extensions.

Various alternative versions of the embodiment shown in Figs. 21 and 22 are possible. For example, in other embodiments, the locations of the side extension fastening adhesive 88 and complementary release surface 89 can be reversed. The amount that the distal edge 56 of the side extensions 52 extends laterally outward can also vary. For example, the side extensions 52, as shown on the right side of Fig. 22, can be folded so that the distal edge 56 extend laterally outboard beyond the laterally outermost portion of the main body portion 21 or the outermost fold formed in the side extensions. Alternatively, as shown on the left side of Fig. 22, the distal edges 56 of the side extensions 52 need not extend this far outward. Regardless of the exact version, the basic embodiment shown in Figs. 21 and 22 provides the advantage the side extensions 52 not only cover the topsheet 38 to help keep the same clean prior to use, but also provide the advantage that the side extensions 52 are conveniently disposed for the wearer to grasp and deploy.

Figs. 23, 23A, and 23B show another alternative folded side extension 52 configuration. As shown in Fig. 23, the side extensions 52 are folded inward over the garment side 20B of the main body portion 21. The side extension 52 is provided with a tab 118 extending from its distal edge 56. The tab 118 is then folded back so that its distal end 120 forms a graspable tab for the wearer to pull on to deploy the side extension 52.

The tab 118 can be joined to the distal edge 56 of the side extension 52 in any suitable manner. The tab 118 can, for example, either be integral part of the side extension 52, or a separate element attached to the side extension 52. In the preferred embodiment shown in Fig. 23, the tab 118 is a separate element that is joined to the side extension 52. Such a configuration is useful because as shown in Fig. 23B it provides the tab 118 with an in-use orientation that is spaced away from

the wearer's leg (shown by the dotted line). This will eliminate any potential discomfort to the wearer from the side extension 52 or the tab 118 rubbing against the wearer's leg.

Figs. 23, 23A, and 23B also provide an example of a sanitary napkin having a folded configuration in which the side extension fastener 88 is held in a folded configuration prior to use by a complementary release surface 89 located on the garment side 20B of the main body portion 21.

Fig. 24 shows another alternative side extension 52 embodiment. The side extension 52 shown in Fig. 24 comprises two (or more) weakened or deformed zones. In the embodiment shown in Fig. 24, the weakened zones are zones of extensibility 130 that are provided by ring rolling or "SELFing" these zones (or by any other suitable manner). The zones of extensibility 130 comprise a first zone 130A and a second zone 130B disposed on opposite sides of the side extension transverse centerline (or flap transverse centerline) T_1 .

The first zone 130A and second zone 130B preferably extend along the longitudinal edges 22 of the main body portion 21. There may be a space in the region of the side extension transverse centerline T_1 between the first and second zones of extensibility as shown in Fig. 24. In alternative embodiments, it is possible that the first and second zones 130A and 130B will be in an abutting relationship. The first and second zones 130A and 130B may extend longitudinally from the side extension transverse centerline T_1 to the end edge 57 of the side extensions. Alternatively, in less preferred embodiments, there may be a gap between the end of at least one of the zone of extensibility and the adjacent end edge 57 of the side extension which is not ring rolled or "SELFed". The zones of extensibility 130 may be of any suitable width. Preferably, however, the zones of extensibility 130 have a width (measured perpendicular to the adjacent longitudinal side edge 22 of the main body portion) that is between about 4 mm and about 20 mm.

In the embodiment shown in Fig. 24, the fold lines 132 in the ring rolling or SELFed deformations run at an angle, A , (inward) relative to the principal longitudinal centerline L . The primary components of extensibility are perpendicular to these fold lines or deformation lines 132. The first zone 130A, thus, has a primary component of extensibility, D_1 , that is oriented roughly parallel to the adjacent longitudinal edge 22 of the main body portion 21. The second zone 130B has a primary component of extensibility, D_2 , and fold lines or deformation lines 132 that

are also oriented at an angle relative to the principal longitudinal centerline. The fold lines of the ring rolling or SELFed deformations 132 form angles, A, as shown relative to the principal longitudinal centerline L that are greater than 0 degrees and less than 90 degrees, and are preferably between about 30 degrees and about 60 degrees, and most preferably about 45 degrees. In such a most-preferred embodiment, where both angles, A, are 45 degrees, the fold lines (or ridges) 132 in the corrugations are oriented perpendicular to each other. The primary components of extensibility for the two regions are also perpendicular to each other.

The side extension embodiment shown in Fig. 24 displays a very unique property. Specifically, each of the zones, first zone 130A and second zone 130B, are able to extend to relieve the stresses which develop on the side extensions 52 when the side extensions 52 are folded around the curved side edge of the wearer's panties. However, the overall side extension 52 is substantially inextensible under the forces associated with wearing the panties since the extensibility of the first zone and second zone oppose each other, and preferably negate each other.

The side extensions 52 shown in Fig. 24 also preferably comprise at least three regions having different stiffnesses and flexibility characteristics. The first and second zones 130A and 130B preferably define first regions of flexibility, I, of the side extensions 52. These are some of the most flexible and drapable regions of the side extensions. The distal edge regions 52C of the side extensions 52 preferably define third regions, III, which are some of the stiffer regions of the side extensions 52. As noted previously, this provides the side extensions 52 with greater stability and ease of handling. The intermediate regions of the side extensions disposed between the first and second zones and the distal edge region define the second regions of flexibility, II. These intermediate second regions II are preferably flexible, but of an intermediate flexibility which is more flexible than the distal edge regions, but less flexible than the first and second zones of extensibility.

The first regions I, preferably have a Flexural Rigidity of less than or equal to about 300 milligrams-cm, and more preferably have a Flexural Rigidity of about 30 mg-cm. The third regions III, preferably have a Flexural Rigidity which is greater than or equal to that of the first regions I and also greater than or equal to about 400-500 mg-cm, and most preferably equal to about 1600 mg-cm. It is believed that the upper limit on the Flexural Rigidity may be as high as about 4,000 mg-cm.

The properties displayed by the side extension 52 shown in Fig. 24 can also be created in other manners. In other words, these properties are not limited in scope to ring rolled or SELFed structures. Fig. 24A shows an alternative embodiment in which the side extension 52 is provided with a plurality of cuts or slits that are in the form of a repeating diamond-shaped pattern. The pattern shown in Fig. 24A can also be rotated so that the diamond-shaped pattern is oriented in any other suitable manner. In other alternative embodiments, the side extensions 52 could be embossed with a suitable pattern, rather than having cuts formed therein. All of such embodiments preferably have weakened areas formed therein (that function like a plurality of small hinges) to allow portions of side extension to fold in any direction. Thus, it is possible to achieve similar effects using a macro pattern such as that shown in Fig. 24, or with a micro pattern comprising small deformities or the like distributed across entire areas of the side extensions 52 as shown in Fig. 25. Any zones of extensibility created therein preferably have primary components of extensibility (or at least some component thereof) that are directed toward each other (and are preferably perpendicular to each other) so that the extensibility of the different zones are at least partially opposed to each other.

Figs. 25 and 26 show another alternative side extension 52 embodiment. This embodiment, as shown in Fig. 25, comprises a pair of spaced apart fan-shaped ring rolled or SELFed regions 140 located on opposite sides of the side extension transverse centerline T₁. The side extension 52 shown in Figs. 25 and 26 is provided with excess or flaccid material 144 along the distal edge 56 of the side extensions 52. This excess material may be referred to as "flare" (to use a term from the garment industry). This flaccid material 144 is created by spreading and then attaching the curved proximal edge 54 of the side extension to the main body portion 21 as described in conjunction with Fig. 14. The distal edge 56 of the side extension 52 is not extensible or stretchable. The side extension 52 is also not pleated or slit. The side extension 52, thus, also has no tendency to retract, and provides a smooth, flat surface for good fit when folded around the edge of the wearer's panties.

When the sanitary napkin 20 is laid out on a flat surface with its backsheet flat on a flat surface, S, such as a table, and the ends 57 of the side extensions are pushed flat against the table, there is a flaccid material 144 that lies out of the plane defined by the surface, S, of the table. The distance the flaccid material lies out of the plane defined by the surface, S, is measured when this material is pinched together. Preferably, the dimension shown under these conditions is greater than or equal to about 10 mm (or equal to a total flare of greater than or equal to about two times

this, or 20 mm). The sanitary napkin shown in Fig. 24 has the advantage that the flaccid material 144 can straighten when the side extensions 52 are folded around the edge of the wearer's panties to better fit the panties. The strengthening of the side extensions 52 is accomplished without stretching or otherwise lengthening the side extensions 52.

H. Fasteners for Attaching the Sanitary Napkin to the Wearer's Panties.

The garment surface 20B of the sanitary napkin 20 and the garment surface of the side extensions 52, as noted above, may include fasteners 82 for attaching the sanitary napkin to the undergarment of the wearer. The sanitary napkin 20 is, as shown in FIG. 4, preferably is at least provided with two end fasteners 84 which are adapted to secure the portion of the sanitary napkin underlying the main body portion 21 to the crotch region of an undergarment. The end fasteners 84 are preferably inextensible fasteners, such as inextensible adhesive patches. The end fasteners 84 serve to firmly anchor the ends of the main body portion in the wearer's panties. The inextensible end fasteners 84 can comprise any adhesive or glue used in the art for such purposes can be used, with pressure-sensitive adhesives being preferred. One suitable adhesive for use as the end 3 Sigma 3153 manufactured by 3 Sigma. Other suitable adhesive fasteners are described in U.S. Patent 4,917,697.

The perimeter fastener 86 is preferably an extensible fastener, such as an extensible adhesive. The extensibility of the perimeter fastener 86 assists the portions of the sanitary napkin between the ends of the main body portion 21 in extending during use. One suitable extensible adhesives for use as the perimeter fastener 86 Fuller 2238 hot melt adhesive manufactured by the H. B. Fuller Co. of St. Paul, Minnesota, which is applied in a spiral pattern.

Other suitable fastener configurations are shown in PCT International Patent Publication No. WO 92/04000 entitled "Shape and Adhesive Fastening Means for an Absorbent Article" published in the name of Papa, et al. on March 19, 1992; PCT Publication No. WO 93/01783 published in the name of Olsen, et al., and in PCT Publication No. WO 93/01785 published in the name of Osborn, et al.

It should be understood that if it is desired to make the component that forms the garment surface of the sanitary napkin (and any overlying components) extensible in the wearer's panties, the particular adhesive configurations that can be used depend on whether extensible or inextensible adhesives are used. The portion of the sanitary

napkin on which extensible adhesives are located will be extensible. Sanitary napkins containing inextensible adhesives will typically only be capable of extension between the inextensible adhesive patches. Therefore, if inextensible adhesives are used, they are preferably applied in intermittent patterns, including but not limited to intermittent dots, intermittent strips, and the like, to permit the sanitary napkin to extend between adhesive patches. If, on the other hand, the adhesive is extensible, the adhesive can be applied in continuous or intermittent patterns in the above configurations (and other configurations). If the adhesives are extensible, they preferably extend approximately the same amounts as the sanitary napkin as set forth in Table 1.

In addition, other types of fasteners can be used instead of, or in addition to adhesives. These other types of fasteners are preferably arranged in patterns similar to those in the patent publications referred to above. Such fasteners include, but are not limited to conventional VELCRO hook material, the fasteners described in: U.S. Patent 4,946,527 issued to Battrell on August 7, 1990; U.S. Patents 5,058,247 and 5,116,563 issued to Thomas, et al. on October 22, 1991 and May 26, 1992, respectively; and EPO Patent Application Publication No. 0 381 087 published August 8, 1990; or, high coefficient of friction foams and other high coefficient of friction materials. These fasteners may also be made extensible as described in U.S. Patent Application Serial No. 07/915,133 (PCT Publication No. 93/01785).

The side extensions 52 may be in the nature of side wrapping elements which, as noted above, should fold around the side edges of the wearer's panties and stay folded without being provided with fasteners to secure the same to the panties. However, other embodiments of the present invention may have optional fasteners thereon for additional security. The optional side extension fasteners 88 can be any of the types of fastening materials specified herein. The optional side extension fasteners assist the side extensions 52 in staying in position after they are wrapped around the edges of the crotch portion of the panty. The side extension fasteners 88 may be located on the garment surface of side wrapping elements 52, adjacent the distal edges 56 of the side wrapping elements 52, or at various other locations on the side extensions, such as close to where the side extensions cross the elasticized sides of the panties.

I. Other Alternative Embodiments

It should be understood that in other embodiments, any of the features of the embodiments described herein may be combined in any suitable fashion to create still other embodiments.

The present invention is also applicable to other types of absorbent articles worn in the crotch region of an undergarment such as pantliners and incontinence articles. The terms "panty liner" or "pantliner" refer to absorbent articles that are less bulky than sanitary napkins which are generally worn by women between their menstrual periods. Examples of suitable absorbent articles in the form of pantliners that can be provided with the features of the present invention are disclosed in U.S. Patent 4,738,676 entitled "Pantliner" issued to Osborn on April 19, 1988.

The term "incontinence article" refers to pads, undergarments (pads held in place by a suspension system of same type, such as a belt, or the like), inserts for absorbent articles, capacity boosters for absorbent articles, briefs, bad pads, and the like, regardless of whether they are worn by adults or other incontinent persons. Examples of suitable incontinence articles that can be provided with the features of the present invention are disclosed in U.S. Patent 5,300,054 issued to Feist, et al. on April 5, 1994, and U.S. Patent 5,304,161 issued to Noel, et al. on April 19, 1994.

3. Test Methods

The procedure for measuring the Flexural Rigidity of the various regions of the side extensions is as follows:

REFERENCE

ASTM Method B1388-64: Standard Methods for Test for Stiffness of Fabrics (modified as described herein).

PRINCIPLE

This test is based on the cantilever beam principle. The distance a strip of sample can be extended beyond a flat platform before it bends through a 45° angle is measured. The inter-action between sample weight and sample stiffness measured as the sample bends or drapes under its own weight through the given angle under specified test conditions is used to calculate the Flexural Rigidity.

GENERAL COMMENTS

The drape test is only one way of measuring a sample's stiffness, and one of the components of sample softness. This method should be followed as closely as possible, however, there will be times in which additional testing is necessary and appropriate. For example, testing of samples in only the longitudinal and transverse directions is described.

In general, a single sample strip should be tested only one time with the body-facing side of the sample facing upward. Likewise, sample strips for use in this test must be very carefully handled to prevent folds, wrinkles, bends, etc. If the sample is placed by the manufacturer in a folded configuration, it should be gently unfolded for the test. If only folded products are available, the Flexural Rigidity can be approximated by measuring a sample taken from between the fold lines. If it is impossible to completely remove the folds from a sample, then the measurement may be taken by orienting the sample with the inward portion of the fold facing upward during the test so that the effect of the fold will be minimized.

APPARATUS

Cantilever Drape Tester	The tester is constructed according to drawing Fig. 27.
1-inch Wide Sample Cutter	JDC Cutter. Obtain from Thwing-Albert Instrument Company, Philadelphia, Pennsylvania.
Paper Cutter	Size convenient for cutting samples to length of 4.0 ± 0.1 or 6.0 ± 0.1 inches.
Conditioned Room	A room conditioned to $73 \pm 2^\circ\text{F}$, $50 \pm 2\%$ Relative Humidity.
Zerostat Anti-Static Pistol (optional)	To eliminate static charge on the drape tester and/or tissue. Distributed in the USA by Discwasher, Inc., Columbia, MO 65201. May be obtained from Morgan Instruments, Inc., P.O. Box 46442, 113 Circle Freeway Dr., Cincinnati, OH 45246. Morgan Catalog No. 70-35-00. Also available from record shops and photographic supply stores. Use of this

pistol is an approved way to remove static charges for this test. Never use fabric softener to remove static charge from a drape test. Operate the Anti-Static Pistol according to the manufacturer's instructions.

SAMPLE PREPARATION

The samples should be placed in an area of the room permitting maximum recirculation of air and maximizing equilibration with the humidity and temperature conditions.

Carefully cut one 1 in. (2.54 cm) wide strip (or as wide as possible) from four representative samples of the absorbent articles to be tested, in both the longitudinal and transverse directions. The length and width of sample may need to be adjusted to allow testing of the appropriate zone of the side extension. The strips should initially be cut so that they run in length from one edge of the zone to be tested to the opposite edge. Mark the direction very lightly on one end with the initials LD or TD.

Carefully make a cut exactly perpendicular to the long dimension of the strip near one end using a paper cutter. It is important that the cut be exactly perpendicular to the long dimension of the strip. As sample strips are cut, the direction of cut is marked lightly on one end.

OPERATION

Using other portions of the samples to be tested, determine the basis weight of the sample in milligrams/cm².

The drape tester 150 (Fig. 27) should be placed on a bench directly in front of the operator. It should be level on the bench as indicated by the small bubble level 152 on the top, and the bench should be relatively free of vibration, excessive heat, and most important - must be free of draft. It is very important that no air current blow directly or indirectly on the tester during operation as this greatly influences the results by causing the sample strip to flutter.

The operator may either sit or stand in front of the tester while it is being used. After the operator has chosen a position in front of the tester which is comfortable, the mirror 154 on the tester must be adjusted so that the upper edge of the two

angular plastic fins 156 extending from the one end of the tester appear to be aligned, or coincident, forming a single plane.

Remove the sample slide bar 158 from the sample slot 160 on the top platform of the drape tester. Place one of the test sample strips 52' on the sample slot so that one end of the sample strip is exactly even with the vertical edge of the tester where the two angular fins are attached. Note that the sample slot is slightly wider than the one inch sample. Place the strip so that it is centered and does not touch the edges of the sample slot. Very carefully place the sample slide bar back on top of the sample strip so that its front edge is also aligned with the edge of the sample strip in the tester. The sample strip will be adjacent to two rulers 162 affixed, one to each side of the sample slot. The sample slide bar 158 must be carefully placed so that the sample is not wrinkled (this does not refer to "wrinkling" inherently associated with the side extension material) or moved forward, and so that the zero mark on one or the other of the rulers also is lined up exactly with the line on the sample slider.

Using very light, gentle pressure on the knob 164 attached to one end of the sample slide bar, and very gently, steadily, and at a rate of approximately $1/3 - 1/2$ in. (0.85 cm - 1.3 cm) per second, move the sample slider forward (toward the end of the tester to which the two fins are attached. As the sample slide bar moves forward, the sample should move at an equal, slow rate. As the sample slider is pushed forward, any tendency of the sample strip to slip can be noted by watching its position with reference to the one of the two indicator lines on the sample slide bar itself. As the sample slide bar and sample strip project over the edge of the tester, the sample strip will immediately or eventually begin to bend, or drape downward. Continue moving the sample slide bar. Stop moving the sample slide bar the instant the leading edge of the absorbent core of the sample strip falls level with the single (coincident and aligned) 45° reference line formed by the two fins as viewed in the mirror. Note: If the sample strip contains a fold line due to the condition which the product was received from the manufacturer, a representative section of the sample strip which does not bend at the fold line should be tested if possible. If it is not possible to eliminate the fold, proceed as described above. Should the sample specimen begin to twist, stop the slide when the mid-point of the leading edge cuts the reference line formed by the two fins. If the twist is greater than 45° , discard the sample and repeat the test on an additional sample strip.

After the sample strip has draped to the degree required for the leading edge of the absorbent core to fall level with the 45° reference line and the sample slide bar

has been stopped, determine the travel of the sample. Mark the point where the sample draped on the sample.

The length of the portion of the sample that draped is then measured from the point it was marked to the end edge of the sample. The portion of the sample that draped is then cut at the marked place. The sample that remains is then weighed in grams and the basis weight for the sample strip is calculated. The test sequence is performed a total of four times for a particular type of absorbent article in each direction (LD and TD). The most flexible direction of the zone is reported.

CALCULATIONS

The equation used to express Flexural Rigidity is as follows:

$$G = W(L/2)^3$$

Where G equals the Flexural Rigidity, W is the sample basis weight in milligrams/cm², and L is the length of the overhang in cm. Results are expressed in (milligrams cm) or "milligrams-cm".

The disclosures of all patents, patent applications (and any patents which issue thereon, as well as any corresponding published foreign patent applications), and publications mentioned throughout this patent application are hereby incorporated by reference herein. It is expressly not admitted, however, that any of the documents incorporated by reference herein teach or disclose the present invention. It is also expressly not admitted that any of the commercially available materials or products described herein teach or disclose the present invention.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. An absorbent article for wearing in a wearer's undergarment that has a crotch regions with a pair of side edges, said absorbent article having a principal longitudinal centerline, a principal transverse centerline, a longitudinal dimension extending in a longitudinal direction and a transverse dimension extending in a transverse direction, said absorbent article comprising:
 - a main body portion comprising an absorbent core, said main body portion having a body-facing side, a garment-facing side, and a pair of longitudinal side edges; and
 - a pair of side extensions for folding around the side edges of the wearer's undergarment, said side extensions joined to the garment-facing side of said main body portion and extending laterally outward beyond the longitudinal side edges of said main body portion to distal edges, wherein at least one of said side extensions comprises a first region that is substantially laterally inboard of said longitudinal side edges of said main body portion when said side extension is extended, and a second region that lies at least partially outboard of said longitudinal side edges when said side extension is extended, wherein said first and second regions of said at least one said side extensions are extensible, and said first region has a primary component of extensibility generally oriented in the longitudinal direction and said second region that has a primary component of extensibility generally oriented in the transverse direction.
2. The absorbent article of Claim 1 wherein said main body portion is substantially inextensible under the forces acting on the sanitary napkin during wear.
3. The absorbent article of Claim 1 wherein said main body portion is extensible under the forces acting on the sanitary napkin during wear.
4. The absorbent article of Claim 3 wherein said side extensions comprise proximal edges, distal edges, and a pair of ends that are attached to said garment-facing side of said main body portion by an extensible attachment

means that is oriented at an angle relative to the principal transverse centerline of said absorbent article.

5. The absorbent article of Claim 1 wherein said at least one side extension comprises a web material having a strainable network of distinct regions which exhibits at least two-stages of controlled resistive forces to an applied axial elongation along at least one predetermined axis when subjected to applied axial elongation in a direction parallel to said predetermined axis, said distinct regions comprising at least a first region and a second region, said first region having a surface-pathlength that is less than that of said second region when measured parallel to said predetermined axis while said web material is in an untensioned condition.
6. The absorbent article of Claim 1 wherein in said first region of said side extension said web material has a longitudinal axis aligned generally parallel to the principal longitudinal centerline of the absorbent article and said network of said web material comprises a formed portion of a base material, and said first region of said network comprises a plurality of substantially planar, linear regions that are aligned with the longitudinal axis of said web material and said second regions comprises a plurality of deformations which are oriented substantially perpendicular to said longitudinal axis of said web material, and in said second region said web material comprises a formed portion similar to that of said first region of said side extension, but with said longitudinal axis of said web material aligned generally perpendicular to the principal longitudinal centerline of said absorbent article.
7. The absorbent article of Claim 1 wherein said at least one side extension comprises a stiffened region along the distal edge of said side extension.
8. The absorbent article of Claim 1 wherein said at least one side extension is folded under said garment-facing side of said main body portion to form a pocket, and is at least partially inserted into said pocket.
9. An absorbent article for wearing in a wearer's undergarment that has a crotch region with a pair of side edges, said absorbent article having a principal longitudinal centerline, a principal transverse centerline, a longitudinal dimension extending in a longitudinal direction and a transverse dimension extending in a transverse direction, said absorbent article comprising:

a main body portion comprising an absorbent core, said main body portion having a body-facing side, a garment-facing side, and a pair of longitudinal side edges; and

a pair of side extensions for folding around the side edges of the wearer's undergarment, said side extensions joined to the garment-facing side of said main body portion and extending laterally outward beyond the longitudinal side edges of said main body portion to distal edges, wherein at least one of said side extensions is joined to said main body portion at a longitudinally-oriented juncture, said side extension extending from said juncture toward said principal longitudinal centerline and being folded back at a fold line to form a folded section so that said distal edge of said side extension extends laterally outward away from said principal longitudinal centerline, and said side extension being unsecured to said garment-facing side of said main body portion to said fold so that said folded section can unfold and extend transversely when forces are applied to pull said side extension laterally outward.

10. An absorbent article for wearing in a wearer's undergarment that has a crotch region with a pair of side edges, said absorbent article having a principal longitudinal centerline, a principal transverse centerline, a longitudinal dimension extending in a longitudinal direction and a transverse dimension extending in a transverse direction, said absorbent article comprising:

a main body portion comprising an absorbent core, said main body portion having a body-facing side, a garment-facing side, and a pair of longitudinal side edges; and

a pair of side extensions for folding around the side edges of the wearer's undergarment, said side extensions joined to said main body portion and extending laterally outward beyond the longitudinal side edges of said main body portion to distal edges, wherein a first portion of at least one of said side extensions closest to the proximal edge of said side extension is folded over said body-facing side of said main body portion toward said principal longitudinal centerline and frangibly adhered thereto, and a second portion of said side extension comprising the distal edge of said side extension is folded back over

said first portion in a direction away from said principal longitudinal centerline to retain said side extension in a folded configuration prior to use.

11. An absorbent article for wearing in a wearer's undergarment that has a crotch regions with a pair of side edges, said absorbent article having a principal longitudinal centerline, a principal transverse centerline, a longitudinal dimension extending in a longitudinal direction and a transverse dimension extending in a transverse direction, said absorbent article comprising:

a main body portion comprising an absorbent core, said main body portion having a body-facing side, a garment-facing side, and a pair of longitudinal side edges; and

a pair of side extensions for folding around the side edges of the wearer's undergarment, said side extensions joined to and extending laterally outward beyond the longitudinal side edges of said main body portion to distal edges, said side extensions having a transverse centerline wherein at least one of said side extensions comprises at least two zones of extensibility, wherein at least one of said zones of extensibility is located on each side of said transverse centerline of said side extension adjacent said longitudinal side edges of said main body portion, wherein the extensibility of one of said zones of extensibility opposes the extensibility of at least one other zone of extensibility, so that said side extension has an overall extensibility that is less than that of the sum of the extensibility of said zones of extensibility.

12. An absorbent article for wearing in a wearer's undergarment that has a crotch regions with a pair of side edges, said absorbent article having a principal longitudinal centerline, a principal transverse centerline, a longitudinal dimension extending in a longitudinal direction and a transverse dimension extending in a transverse direction, said absorbent article comprising:

a main body portion comprising an absorbent core, said main body portion having a body-facing side, a garment-facing side, and a pair of longitudinal side edges; and

a pair of side extensions for folding around the side edges of the wearer's undergarment, said side extensions comprising proximal edges joined to said main body portion and extending laterally outward beyond the longitudinal side edges of said main body portion to distal edges, wherein said side extensions comprise at least three zones of flexibility comprising a first zone adjacent at least a portion of the proximal edges of said side extensions, a second zone at least partially laterally outboard of said first zone, and a third zone adjacent at least a portion of the distal edges of said side extensions, when said first zone has the highest flexibility of said three zones, second zone has a flexibility that is in between that of the first and third zones, and said third zone having the lowest flexibility of said three zones.

13. An absorbent article for wearing in an undergarment, said absorbent article having a longitudinal dimension oriented in a longitudinal direction, a transverse dimension oriented in a transverse direction, a longitudinal central region extending in the longitudinal direction, and longitudinal side regions laterally outboard of said longitudinal central region, said absorbent article comprising:

a main body portion comprising a liquid pervious topsheet, a liquid impervious backsheet, an absorbent core positioned between said topsheet and said backsheet, a pair of longitudinal side edges, a pair of end edges, and a fastener adjacent each end edge wherein said topsheet and absorbent core are extensible at least in said longitudinal central region of said absorbent article under the forces associated with wearing said absorbent article, and a longitudinal central portion of said backsheet along the longitudinal central region is extensible under such forces while portions of said backsheet are aligned with said longitudinal side regions of said absorbent article are less extensible than said longitudinal central part of said backsheet.

1/16

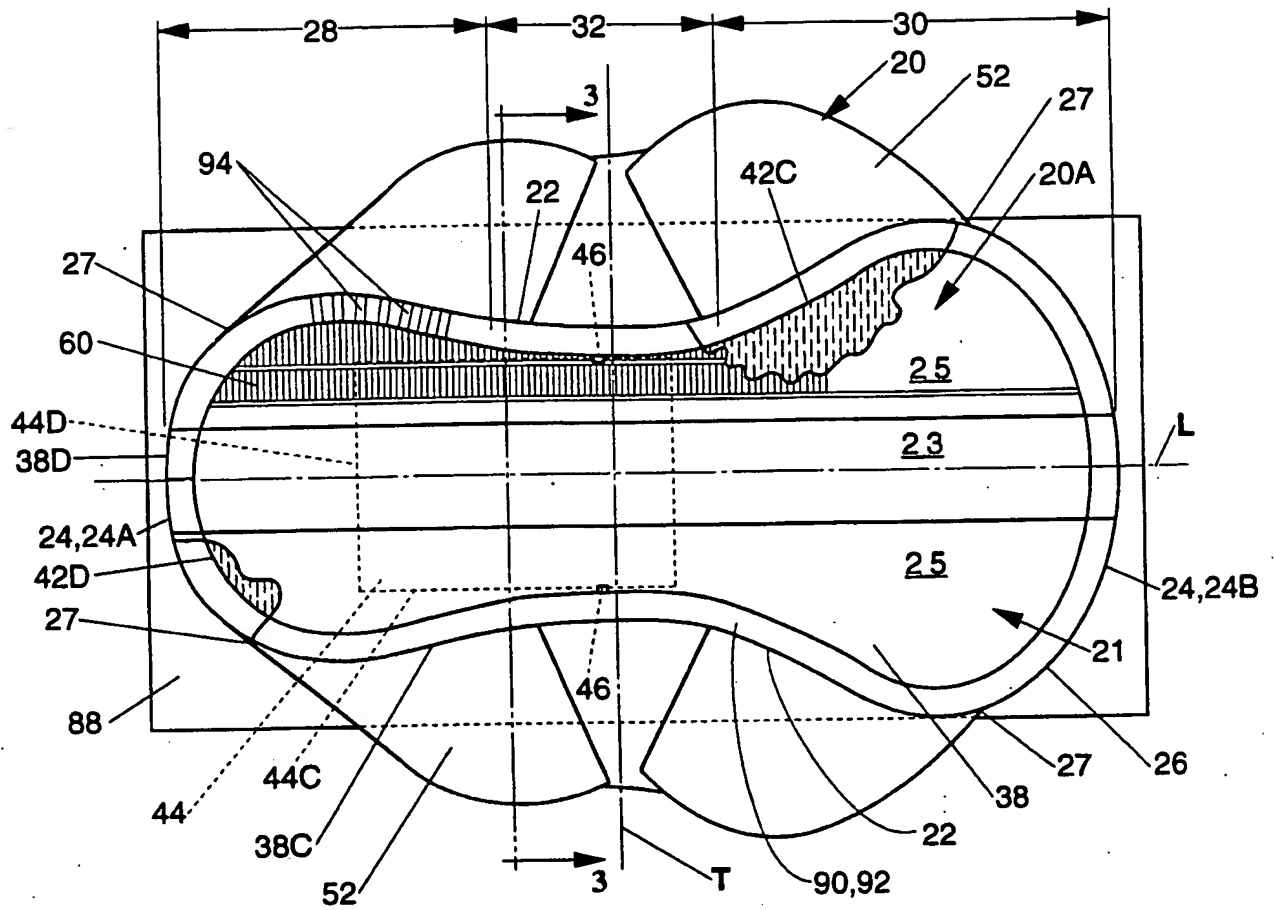


Fig. 1

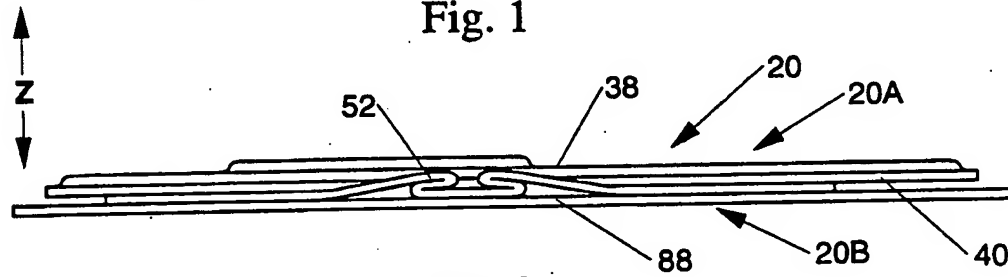


Fig. 2

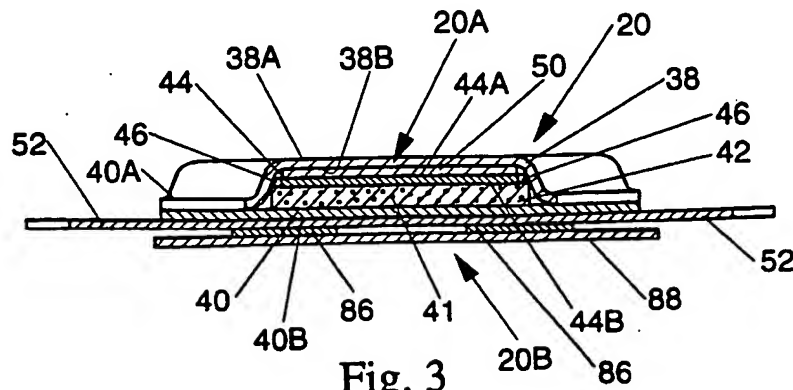


Fig. 3

Fig. 4

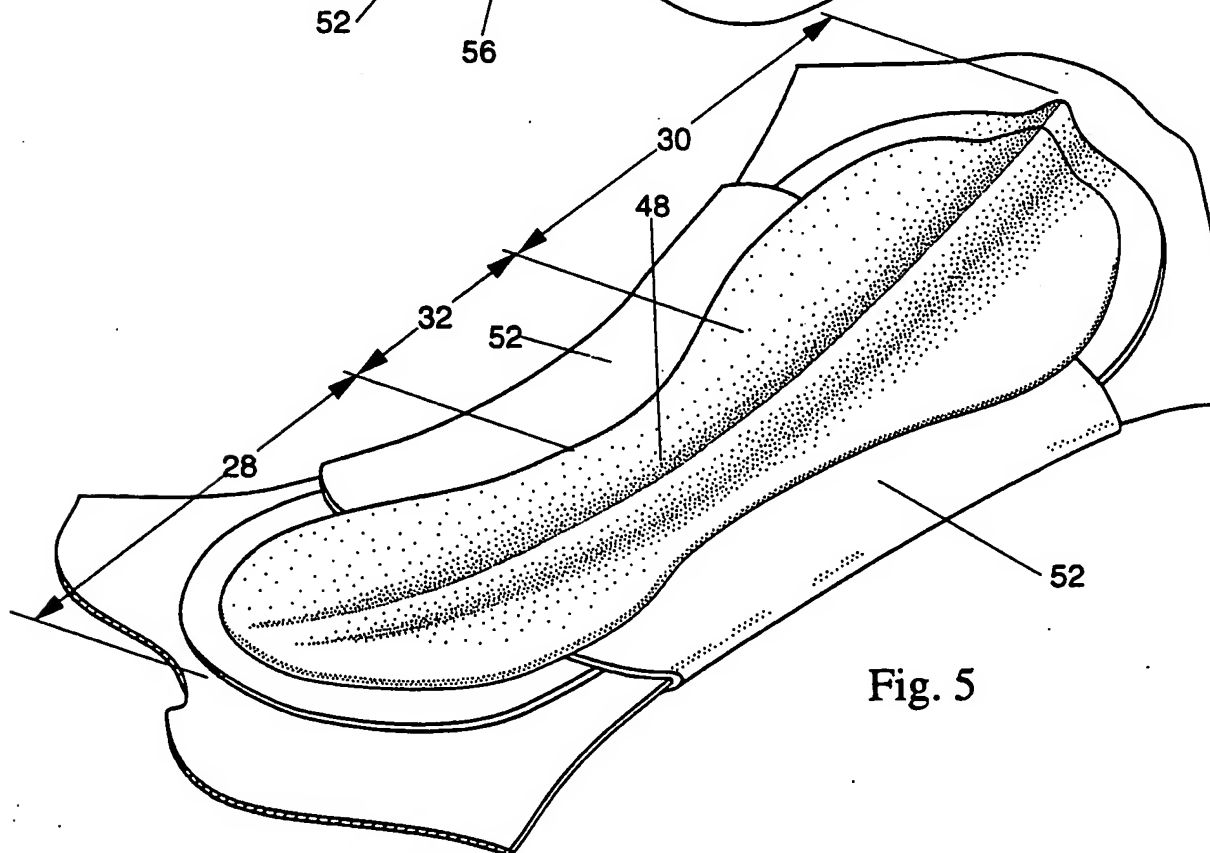
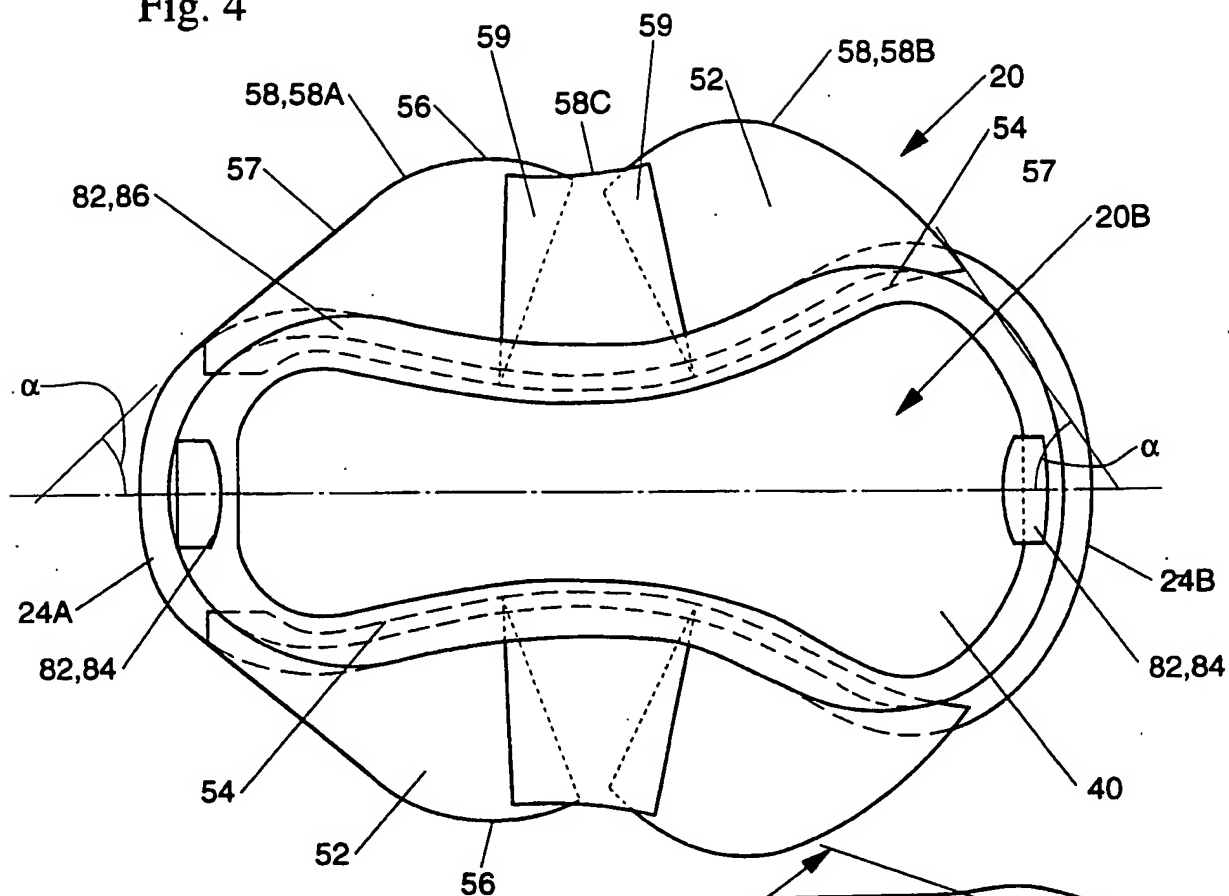


Fig. 5

3/16

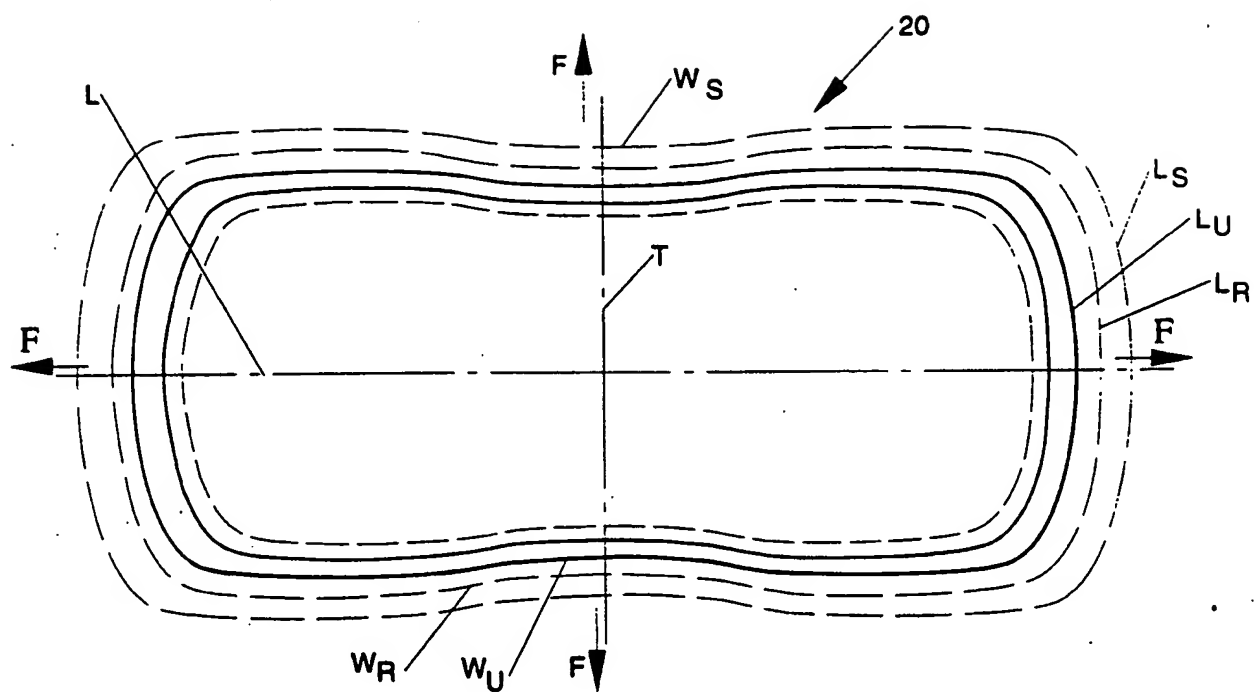


Fig. 6

LONGITUDINAL				WIDTH			ELASTIC WALL	
% LONGITUDINAL STRETCH	g. OF FORCE TO EXTEND PAD	% PAD SET	% WIDTH STRETCH	g. OF FORCE TO EXTEND 1.0" STRIP	% PAD SET	% STRETCH	g. FORCE	
CONDITIONS FOR STRETCH	40%	≤1000 g.	40%	≤500 g.	≤10	50%	1500 g.	
		≤800 g.		≤400 g.	≤25		2000 g.	
	25%	≤800 g.	25%	≤500 g.	≤10	40%	1500 g.	
		≤400 g.		≤400 g.	≤25		2000 g.	
MINIMUM FORCE TO STRETCH	25%	≥300 g.				25%	1500 g.	
		≥50 g.					2000 g.	

4/16

Table 1...Typical Values for Stretch Parameters

Fig. 7

5/16

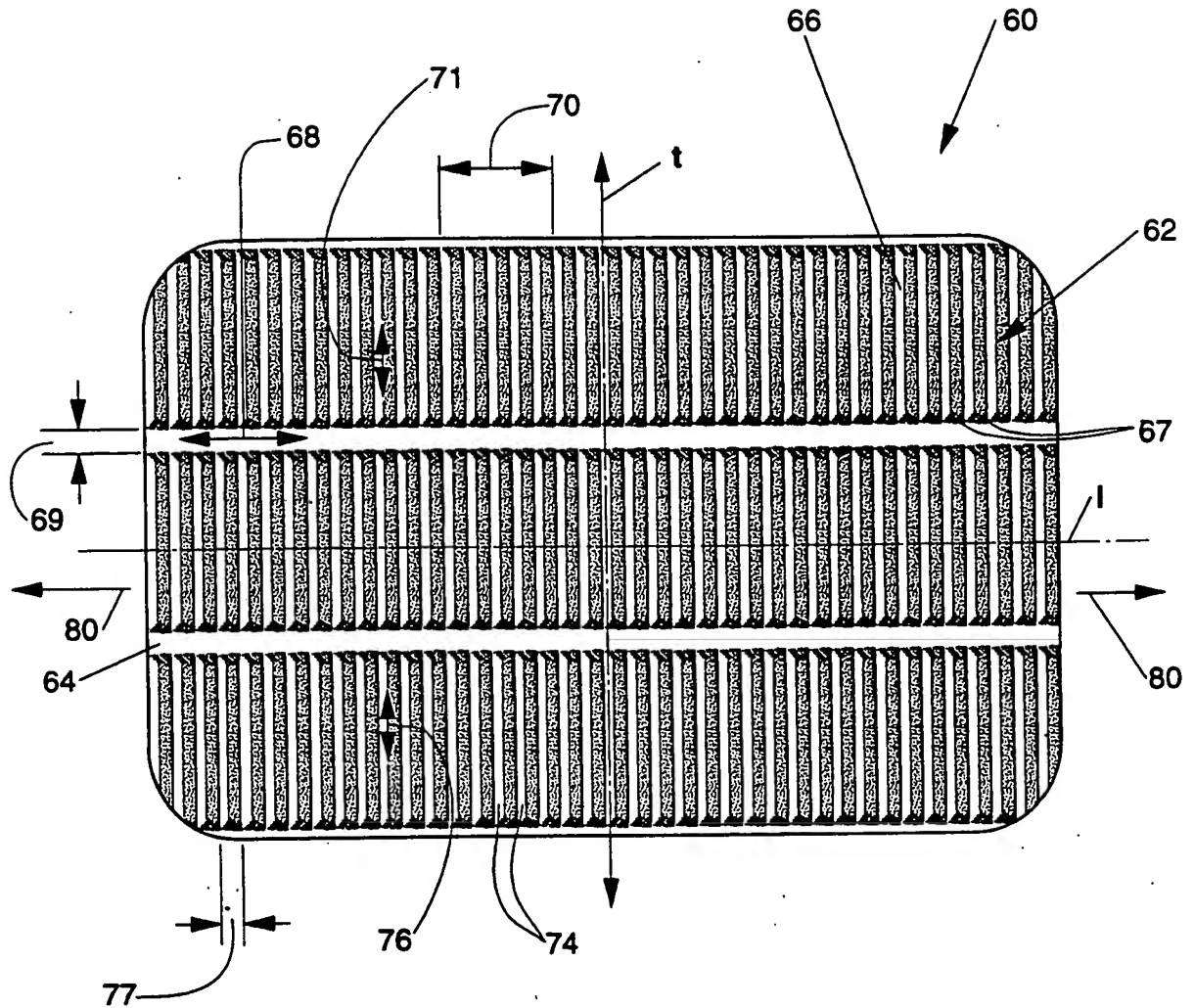


Fig. 8

6/16

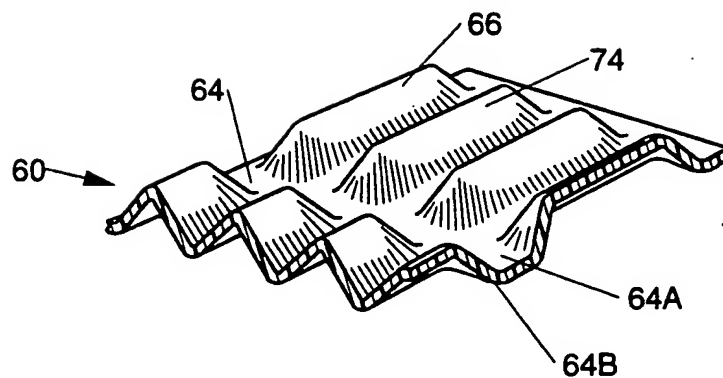


Fig. 9

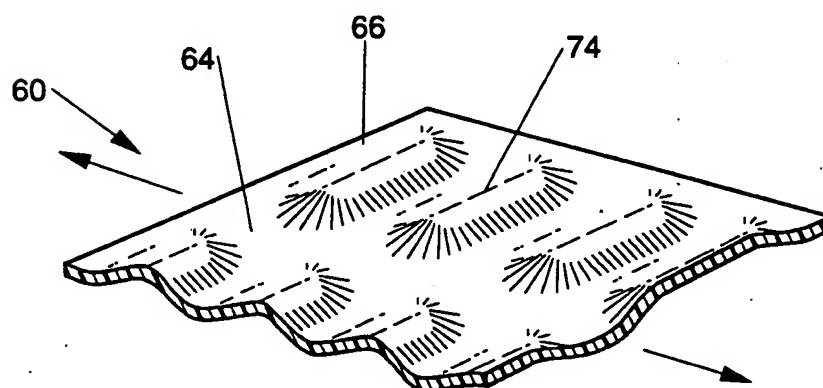


Fig. 10

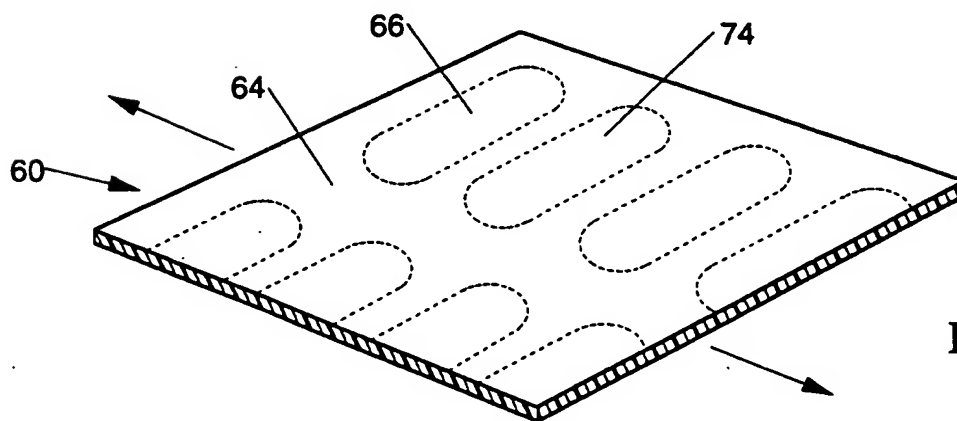


Fig. 11

7/16

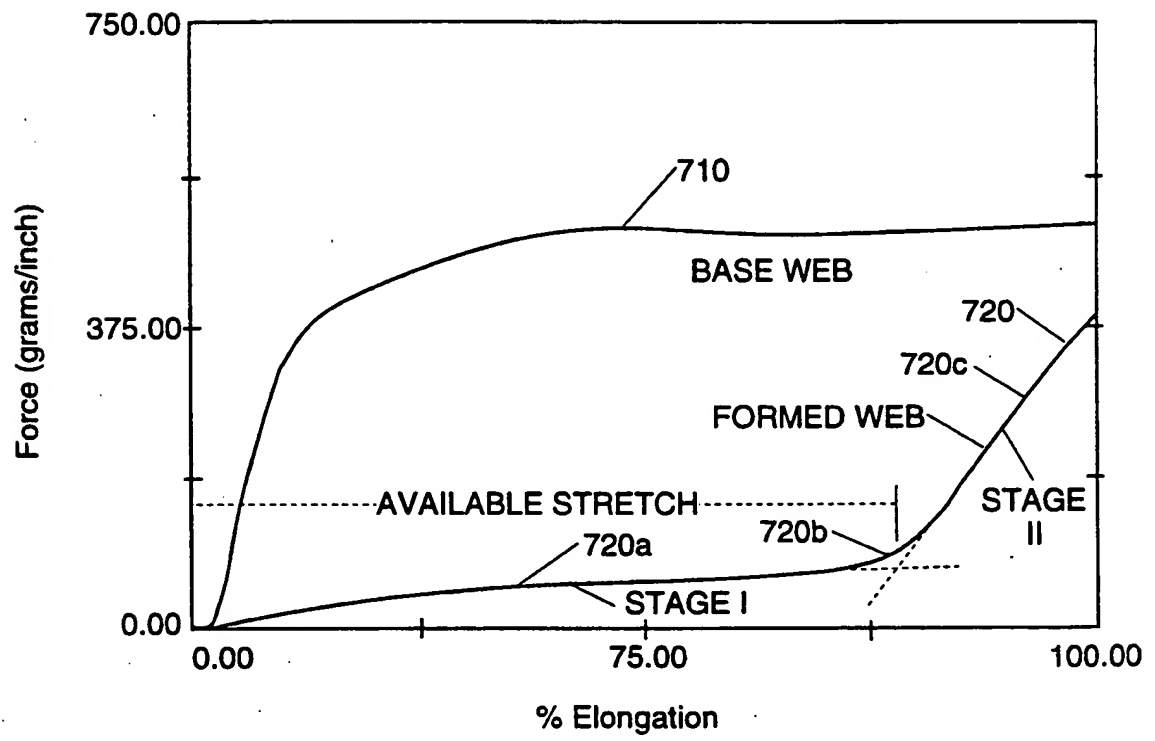


Fig. 12

8/16

Fig. 13

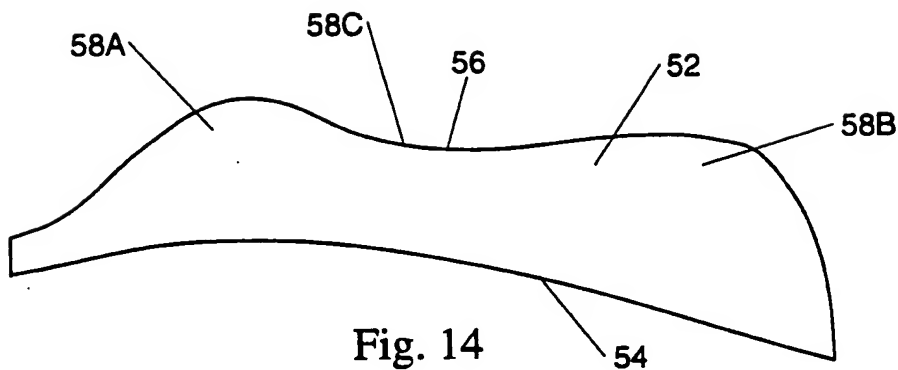
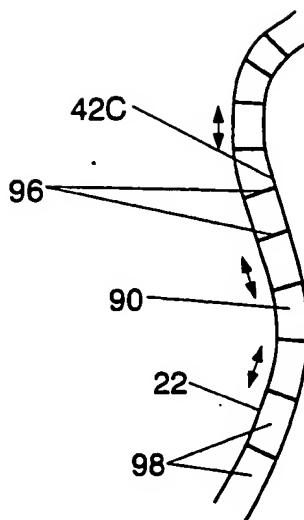


Fig. 14

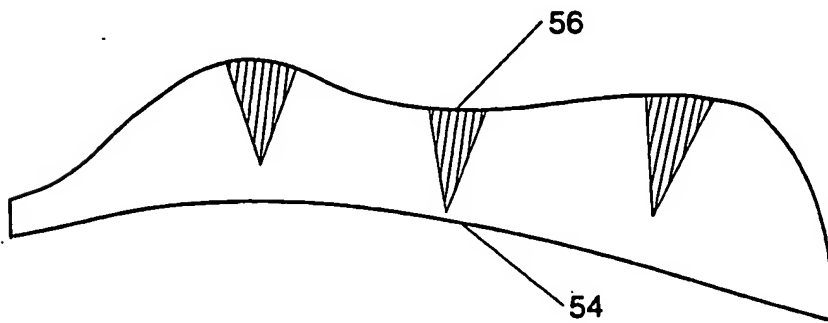


Fig. 15

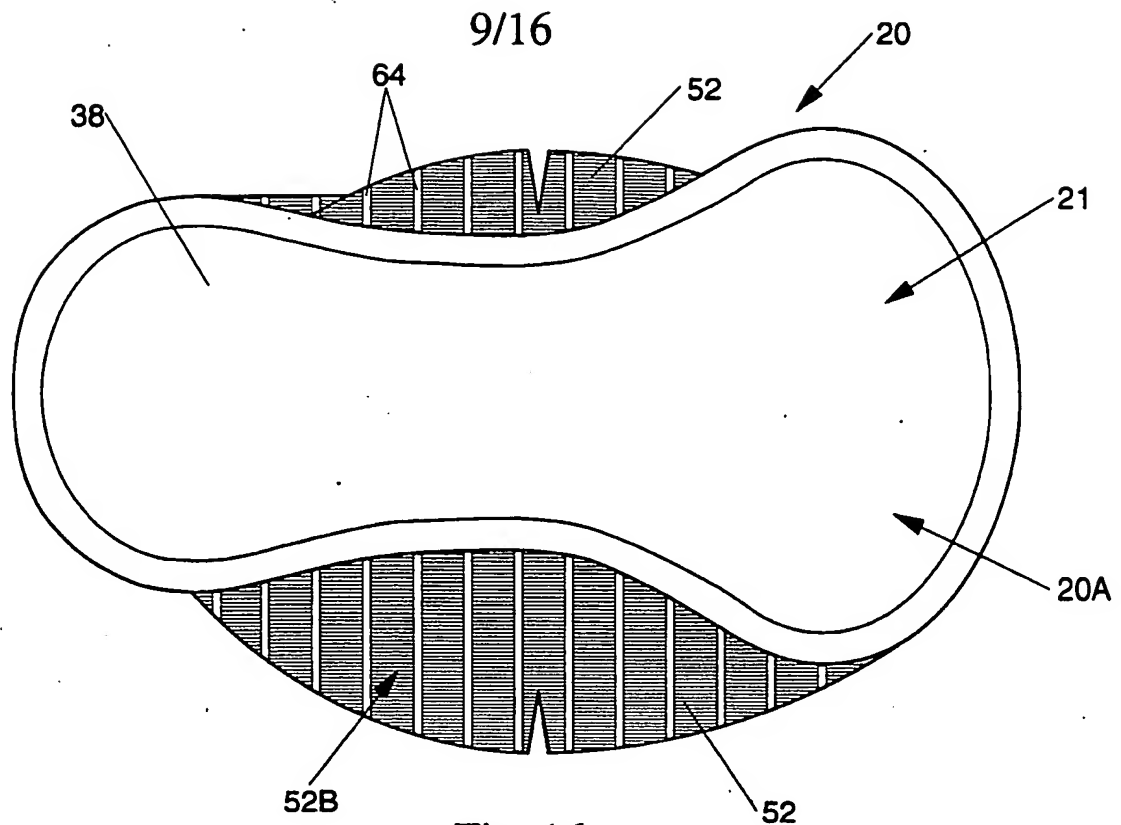
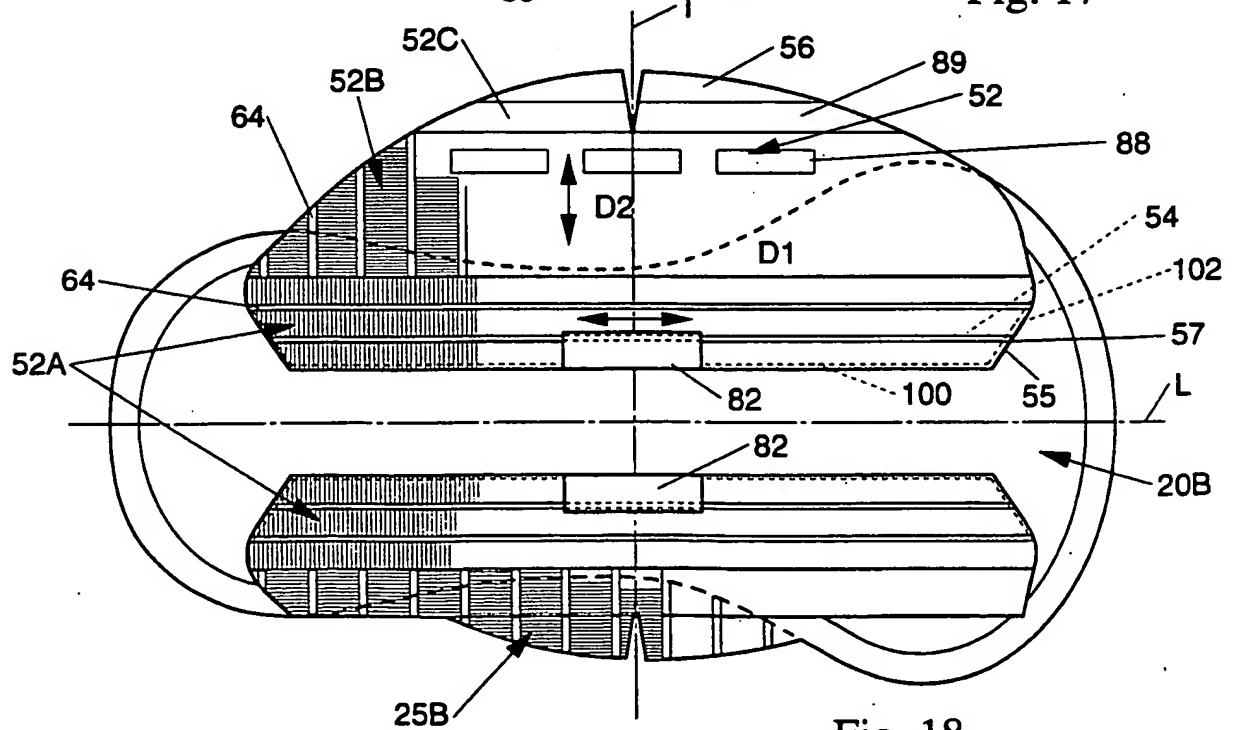
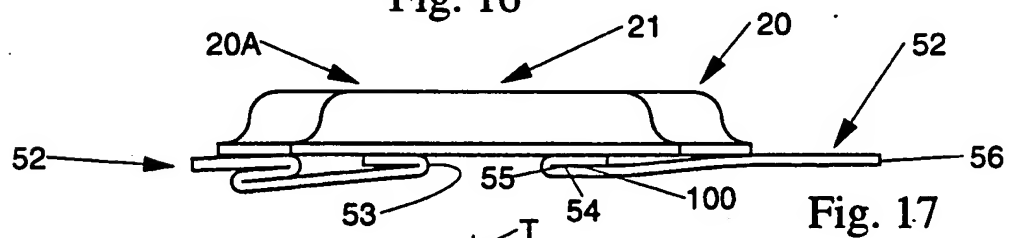


Fig. 16



10/16

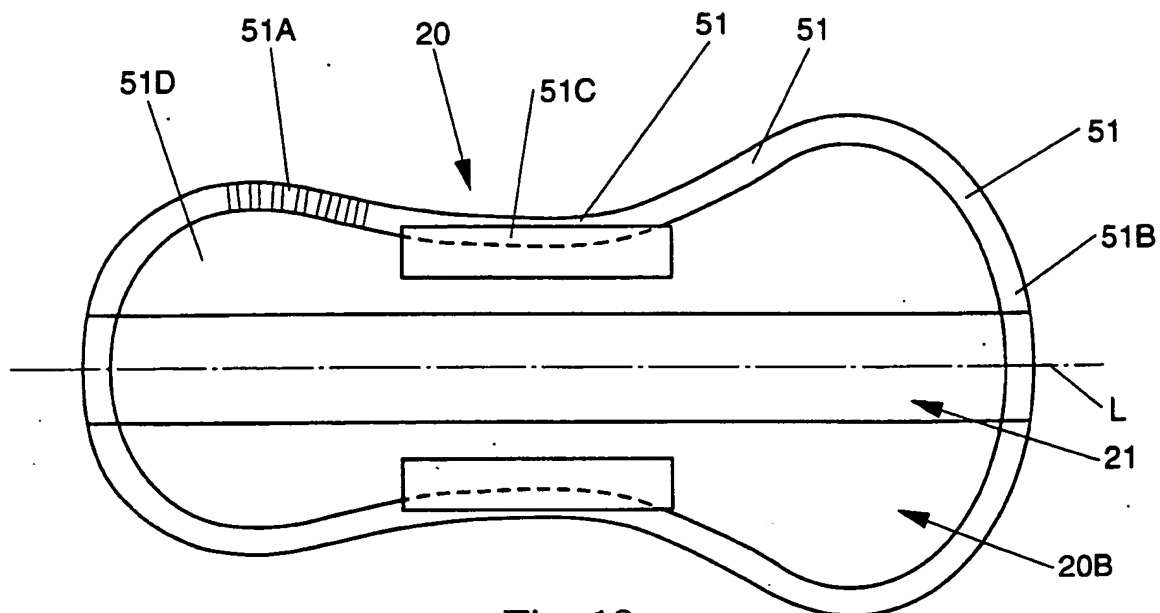


Fig. 19

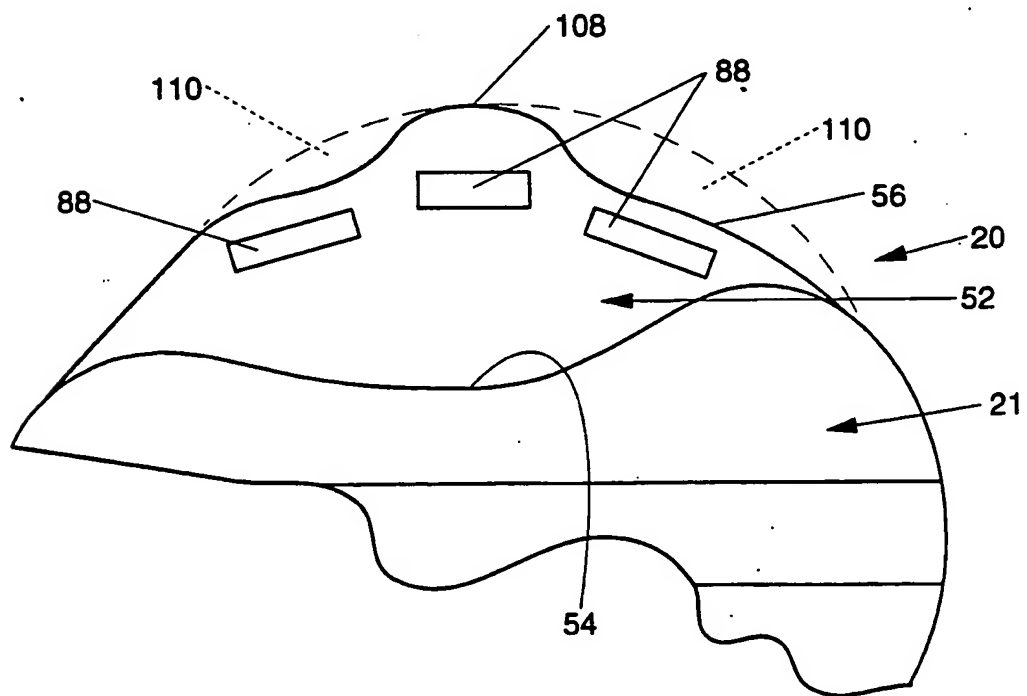


Fig. 20

11/16

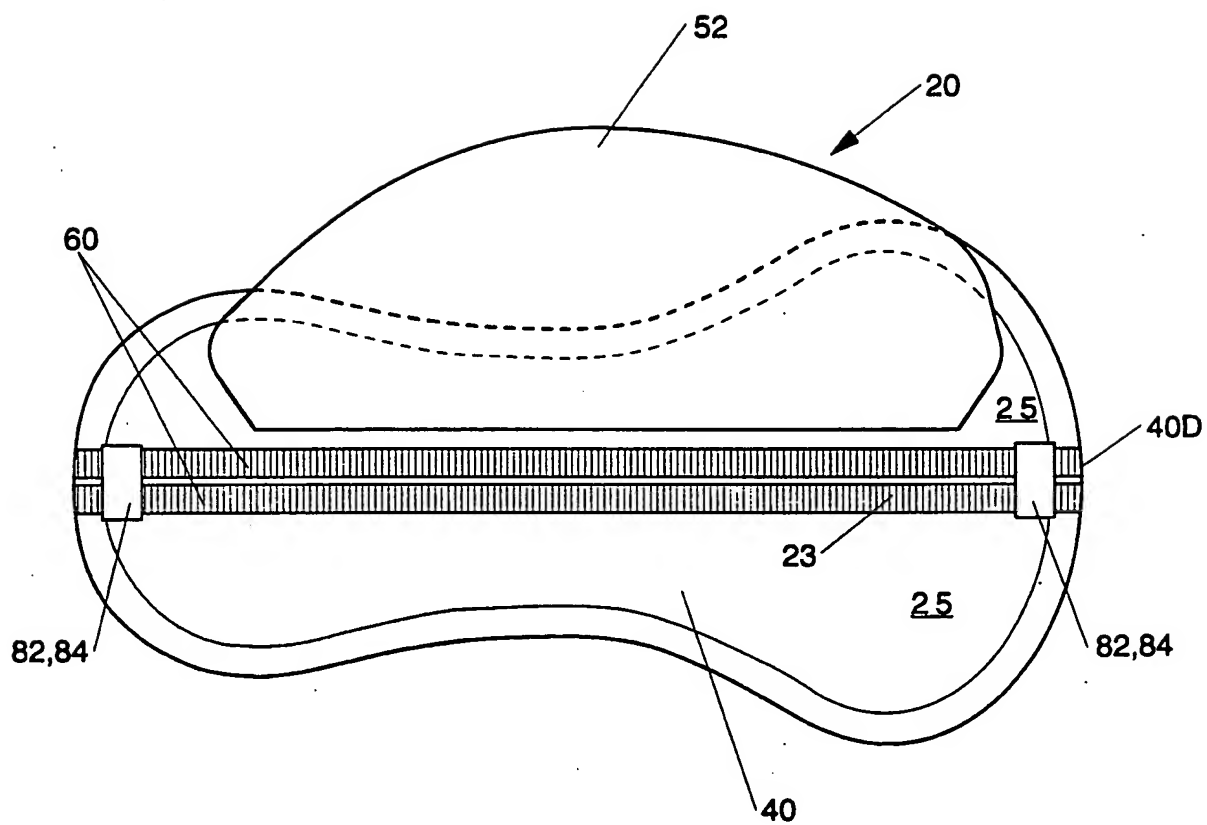


Fig. 19A

12/16

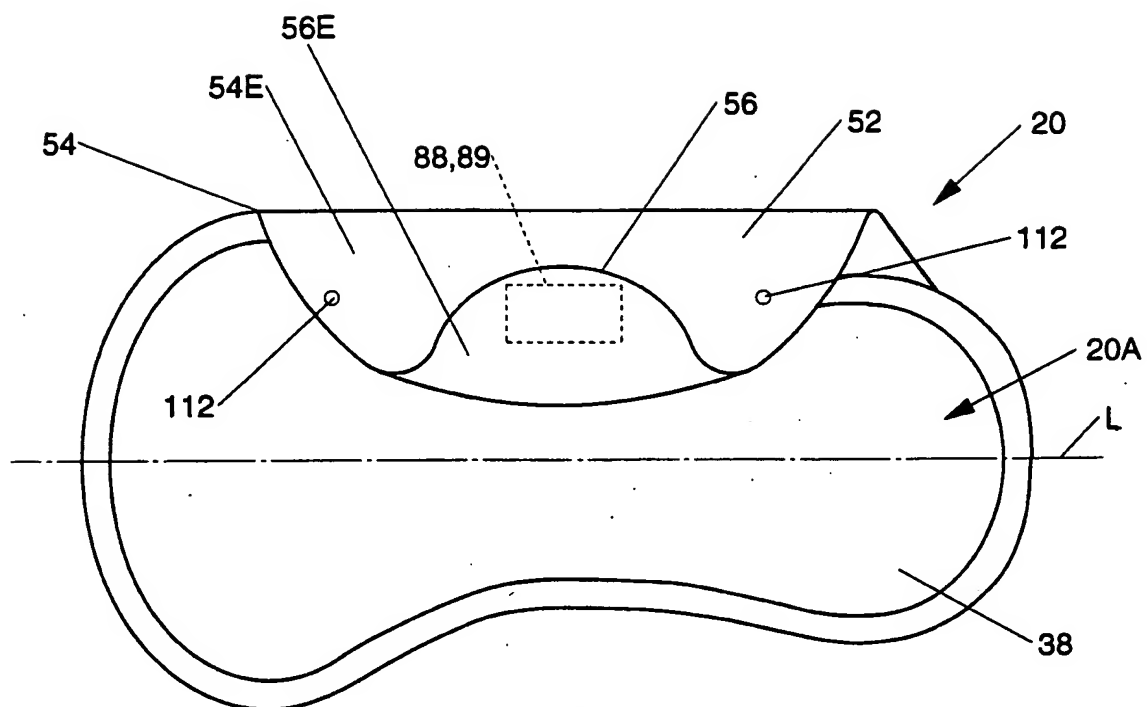


Fig. 21

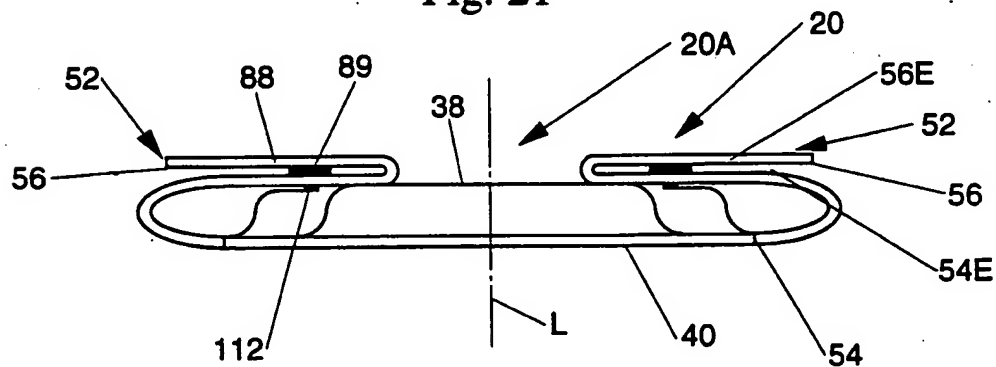


Fig. 22

13/16

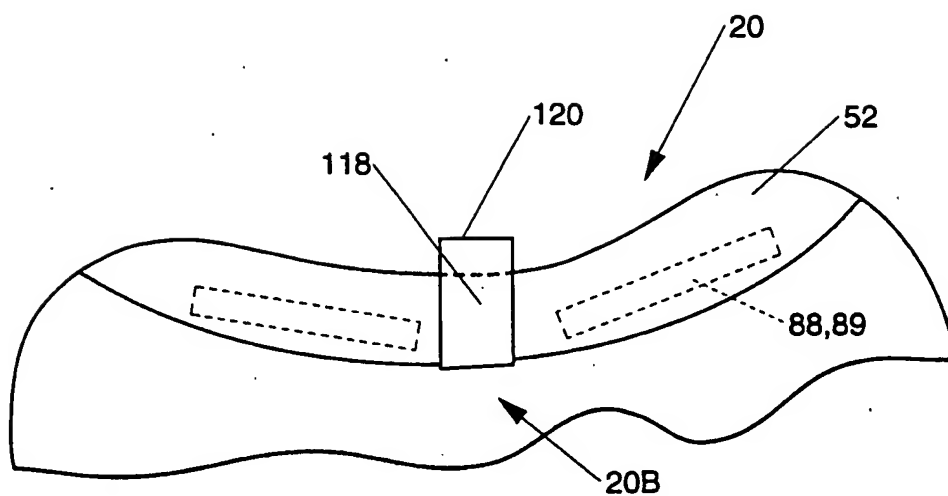


Fig. 23

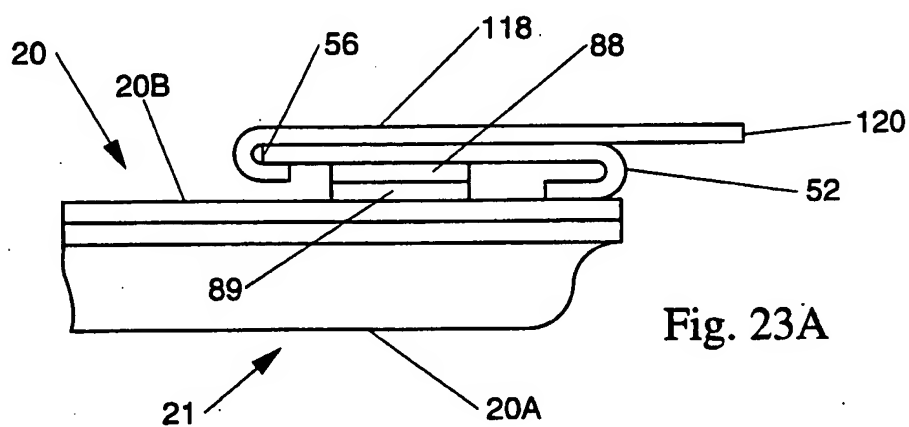


Fig. 23A

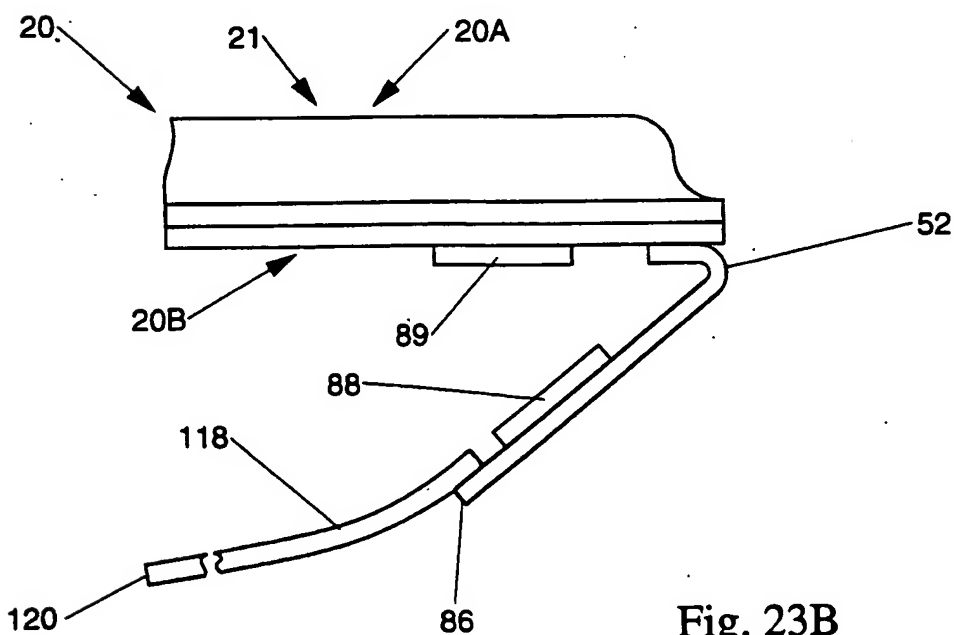
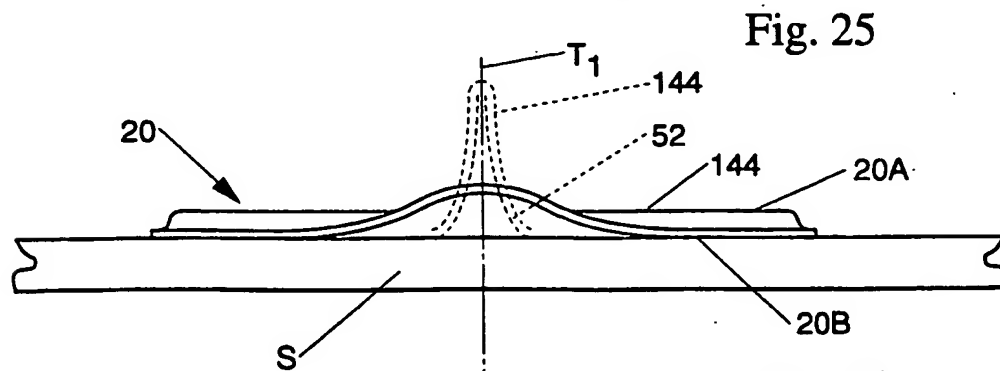
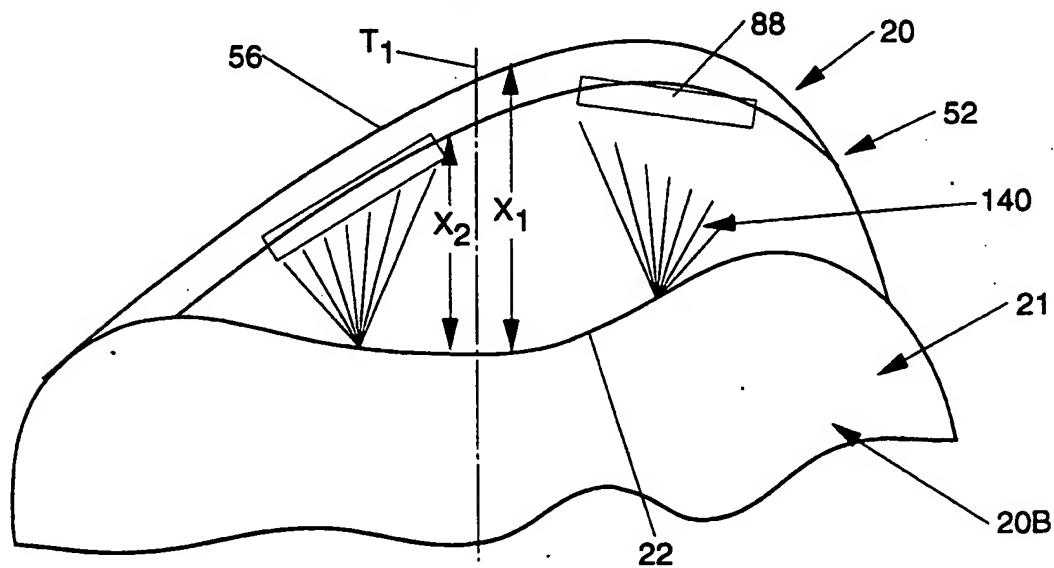
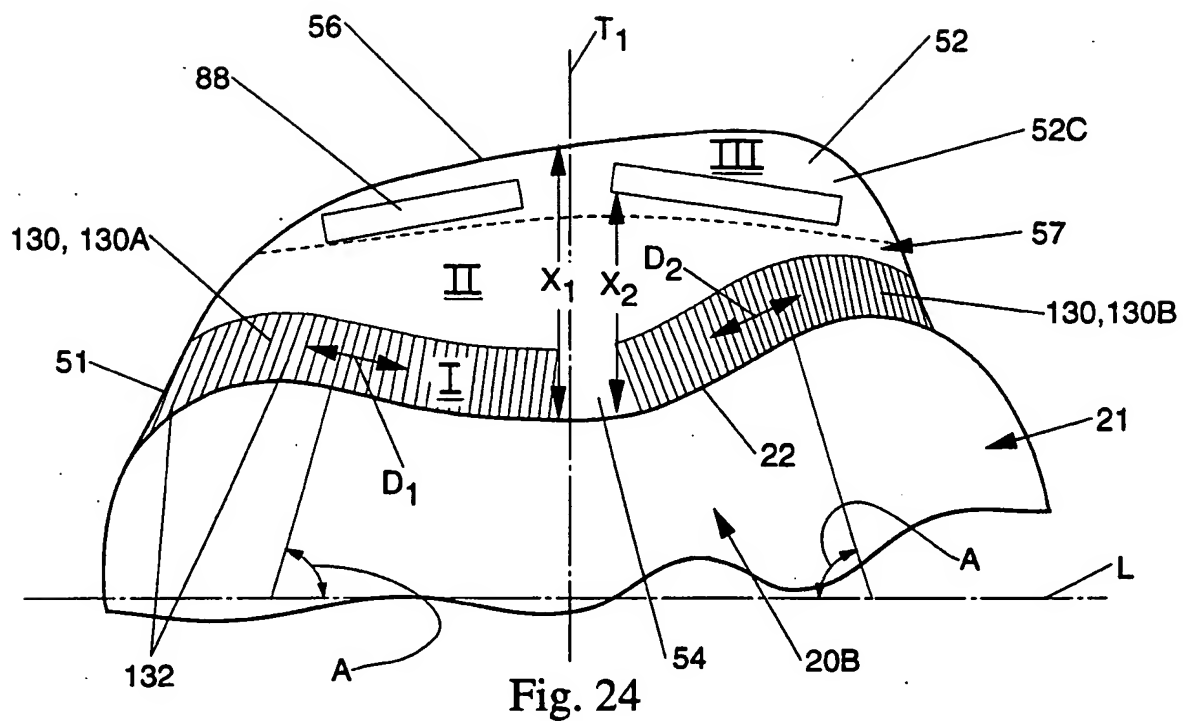


Fig. 23B

14/16



15/16

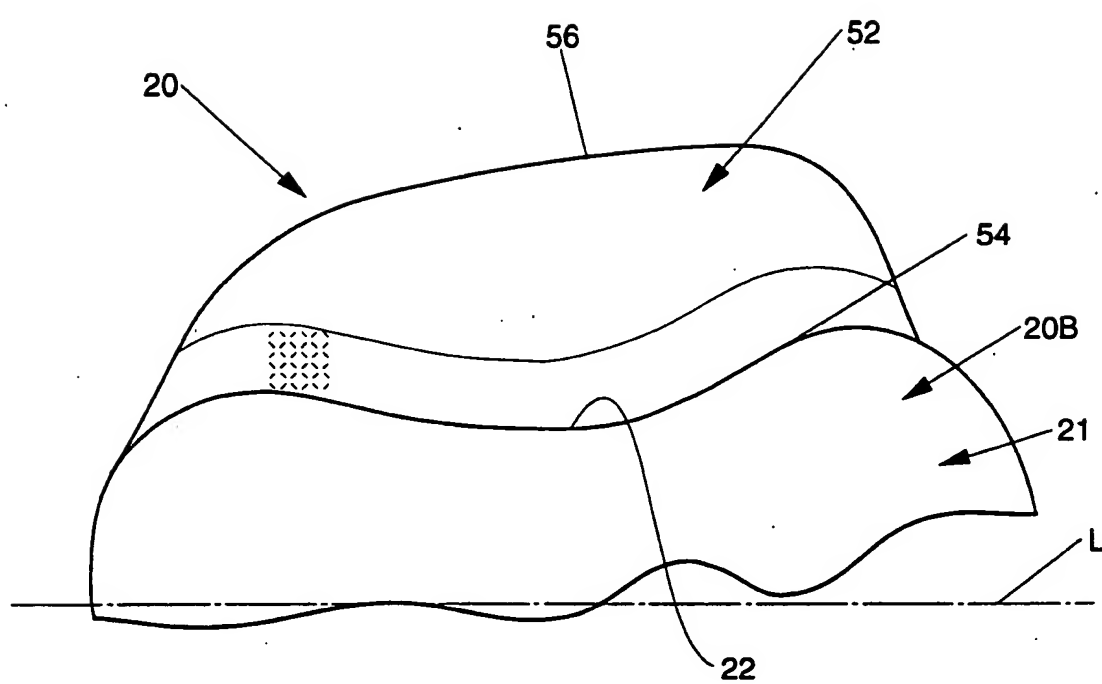


Fig. 24A

16/16

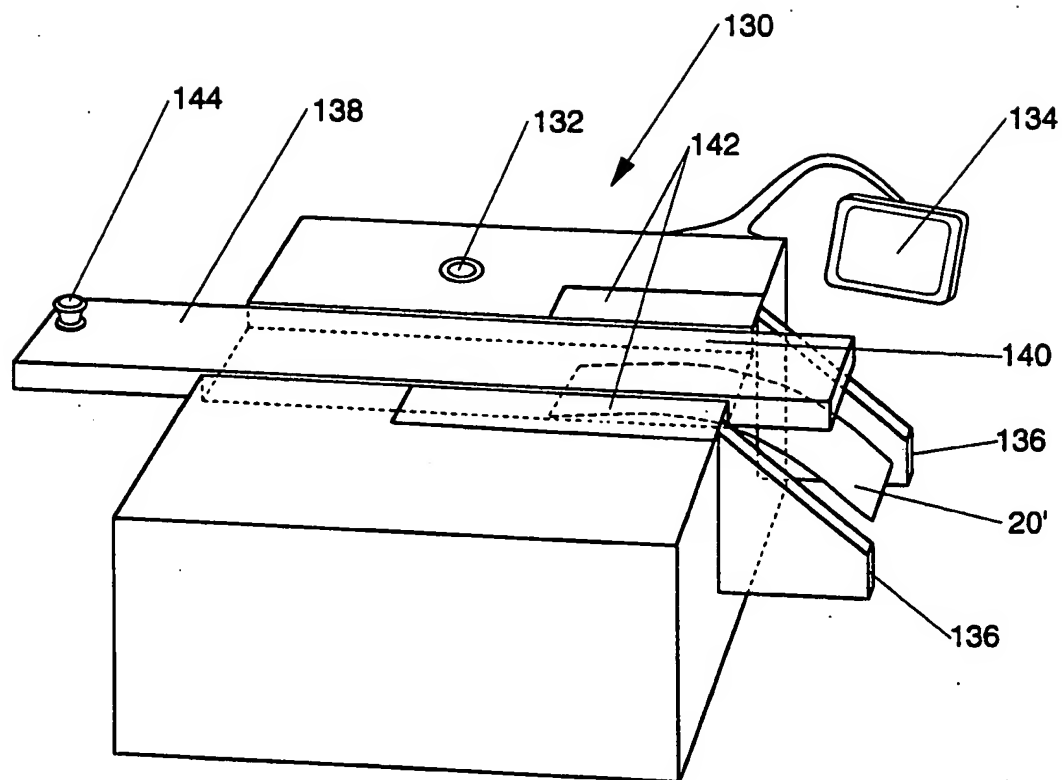


Fig. 27

INTERNATIONAL SEARCH REPORT

Intern: al Application No

PCT/US 95/01525

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,94 00091 (THE PROCTER & GAMBLE COMPANY) 6 January 1994 see page 30, paragraph 2 - page 43, paragraph 3; figures	9
A	---	1
A	WO,A,93 06805 (THE PROCTER & GAMBLE COMPANY) 15 April 1993 see claims; figures	1,10
A	---	1
A	EP,A,0 426 235 (THE PROCTER & GAMBLE COMPANY) 8 May 1991 see claims; figures	1
A	---	1
A	EP,A,0 331 018 (MCNEIL-PPC) 6 September 1989 see claims; figures	1

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Date of the actual completion of the international search

21 June 1995

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-9400091	06-01-94	US-A-	5281209	25-01-94
		AU-B-	4542093	24-01-94
		CN-A-	1086121	04-05-94
		CZ-A-	9402963	12-04-95
		EP-A-	0648100	19-04-95
		FI-A-	946159	29-12-94
		NO-A-	945060	27-02-95

WO-A-9306805	15-04-93	AU-A-	2695992	03-05-93
		CA-A-	2079511	02-04-93
		CN-A-	1073090	16-06-93
		EP-A-	0606358	20-07-94
		FI-A-	941489	27-05-94
		JP-T-	6511171	15-12-94
		NO-A-	941102	01-06-94
		US-A-	5354400	11-10-94
		US-A-	5344416	06-09-94
		CA-A-	2079537	02-04-93
		US-A-	5389094	14-02-95

EP-A-426235	08-05-91	AU-B-	6190494	30-06-94
		AU-A-	6567290	09-05-91
		CA-A-	2028288	02-05-91
		CN-A-	1051856	05-06-91
		EG-A-	18963	30-06-94
		JP-A-	3191958	21-08-91
		NZ-A-	235905	27-04-94
		TR-A-	25636	01-07-93
		US-A-	5354400	11-10-94
		US-A-	5346486	13-09-94

EP-A-331018	06-09-89	US-A-	4940462	10-07-90
		GR-A-	89100117	31-03-94
		JP-A-	2007956	11-01-90

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